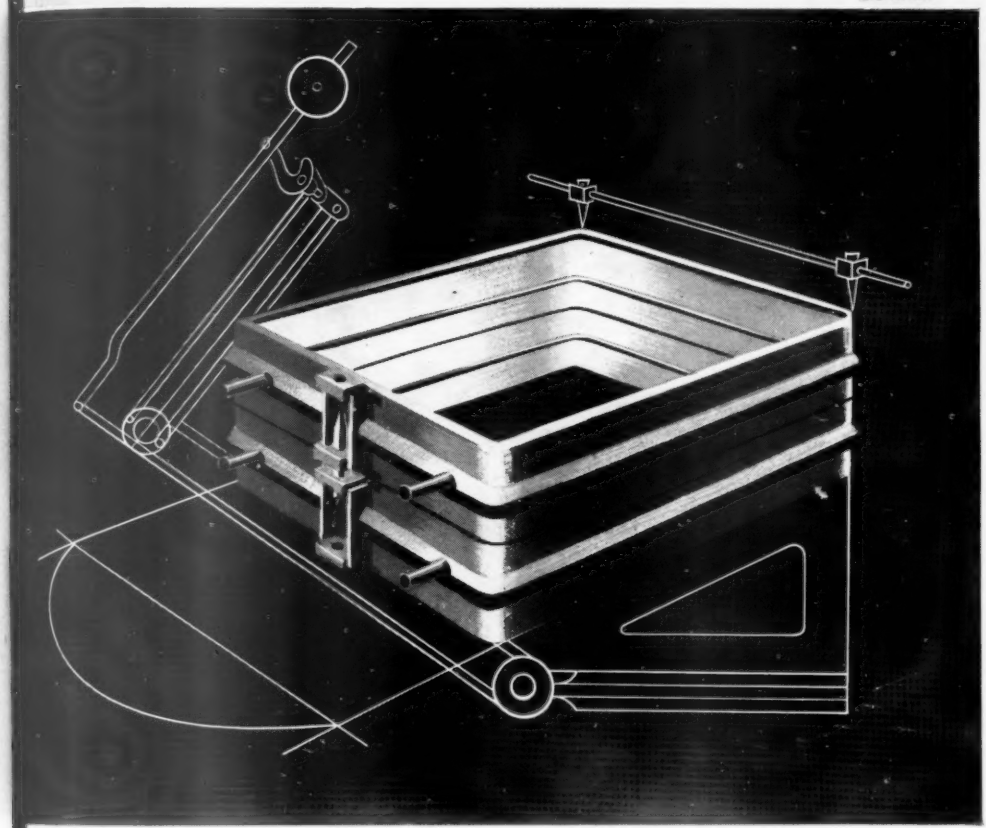
FOUNDRY
EST. 1902 TRADE JOURNAL
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADE JOURNAL
VOL. 100
No. 2064
MAY 3, 1956
Registered at the G.P.O. as a Newspaper
Offices: John Adam House, John Adam St[illegible] W.C.2
Single Copy, 9d. By Post 11d. Annual Subscription, Home 40/-, Foreign 50/- (Prepaid)
MAY 7 1956
EAST ENGINEERING LIBRARY



Interchangeability

Sterling moulding boxes mean less scrapped castings. They drop easily on to the pattern plates or mate one with another without sticking on the pins and affording accurate register. Parting faces are level and true, pin centres equidistant, with the axis of the pins at right angles to the parting faces and in correct relation to the centre line of the box.

Sterling

STERLING FOUNDRY SPECIALTIES LTD., BEDFORD, ENG.

AIR CONTROL IN INDUSTRY

AAF
AMERICAN AIR FILTER CO. INC.

Lloyds (Burton) **Ltd.,** one of the best-known names in iron and steel, is yet another firm that is tackling its dust control problems with the help of Air Control Installations Ltd.

Up to now five Rotoclones have been installed with a total capacity of 65,000 c.f.m., cleaning up sandhandling, shakeouts and fettling.

We specialise in the manufacture of equipment for every form of air treatment and in harnessing air to work for industry. Consult our nearest branch.

AIR CONTROL INSTALLATIONS LIMITED

ACI LTD.

RUISLIP · MIDDLESEX

Ruislip 4066

LONDON	BIRMINGHAM	MANCHESTER	NEWCASTLE	GLASGOW
Welbeck 1306	Midland 1165 & 1367	Central 0679 & 0670	Whitley Bay 23046	Central 2923

ROTOCLONE – The plant that makes your works "NOT SO DUSTY"

FOUNDRY TRADE JOURNAL

Established 1902

Vol. 100 Thursday, May 3, 1956 No. 2064

Editor:
V. C. FAULKNER, F.R.S.A., HON.M.I.B.F.

Assistant Editor: A. R. PARKES, M.I.B.F.
Commercial Editor: P. E. CARDEN.
Advertising Manager: LENNOX HOLT, M.I.B.F.
Production Manager: R. J. LOVELL.
Publisher: H. J. DWYER.
Circulation Manager: E. T. GRIFFITHS.

District Representatives:
G. P. ELLIOTT (*Northern Area*)
T. H. SMITH (*Scotland*)

PRINCIPAL CONTENTS

Technical : PAGE

Welcome to Wales ! Brief descriptions of the works to be visited on June 15, the final day of the Institute of British Foundrymen's conference at Cardiff 255

Association of Bronze & Brass Founders Report of business, technical and social meetings in London, April 24 and 25 . 269

Production Moulding of Components for Cast-steel Bogie Trucks, by J. G. H. Loubser Account of the re-organization and development of moulding methods necessitated by the decision of the South African Railways Administration to manufacture cast-steel bogie trucks in their foundry at Pretoria 273

Features :

Leader: Restrictive Practices . . . 251
Featuring—A. T. Holman . . 252, 253
Dinner: Lake & Elliot 254
Notes from the Branches 268
Book Reviews 272
Forthcoming Events (Advert section) . 40

Commercial :

New Patents, Company News, and Contracts Open 281
Pig-iron and Steel Production in January 282
Raw Material Markets 288
Current Prices of Iron, Steel and Non-ferrous Metals 290

AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Weekly

Single copy 9d.; *by post* 11d.;
Annual subscription: home 40s., *abroad* 45s., (*prepaid*).

17/19 JOHN ADAM STREET, ADELPHI, LONDON, W.C.2

'Phone: TRAfalgar 6171 (10 lines)
'Grams: Zacatecas, Rand. London.

Restrictive Practices

Following a meeting of the National Joint Advisory Council—a body which is sponsored by the Ministry of Labour and National Service—it was decided to ask all industries to tackle the problem of restrictive practices. Mr. Macleod, the Minister, apparently does not like the term restrictive practices; he prefers the positive phrase "the efficient use of manpower." Unlike the case of the employers, this is not to be the subject of legislation. It is agreed that some restrictive practices on the part of the employees are enforced as aids to health and safety. The view was expressed that the problem of securing the efficient use of manpower could not best be tackled on a national basis, but might almost require examination firm by firm. In our opinion, at least so far as the foundry industry is concerned, district by district is the best solution. In some areas, for instance, coremaking is regarded as a trade distinct from moulding; if there be enough work available for everybody, this matters but little, yet in small establishments the limiting of personnel to one or the other could be a drag on production. In some districts, machine moulding is reserved for fully-skilled men, although it is not exactly a job where their skill is used to the best advantage. Possibly, the practice most deleterious to the economy of the country, is the limitation of production which used to be in vogue in the foundries making builders' castings. Here, when the men thought that their quota of moulds had been cast up satisfactorily they would put their foot through the extra moulds they had made as a "safety margin." In other foundries, the men having made their "stint" finished work for the day.

By and large, however, we do not think that restrictive practices are so onerous as those encountered in, say, the shipbuilding trades, where demarcation of trades is so acute that it extends to the foundries or other works in the coastal areas. Such jobs as taking up floor-boards, and the installation of mouldings for electric wires used to be divided between electricians and carpenters according to a size limitation; more recently there has been the ridiculous case as to who should bore holes in aluminium plates. Whilst much progress has been made in recent years in the demarcation of skills, there is trouble in the offing owing to the possible impact of automation on production, where but little promise of co-operation has been evinced by one of the trade unions. Surely this body should remember that there are now many more people engaged in garages than was previously the case in the whole of the horse-transport industries? There is an old truism, which states that "work makes work," and this applies equally well to the eradication of restrictive practices as to the influence of automation.

A. T. HOLMAN, O.B.E., J.P., M.I.Mech.E.

Chairman, Holman Bros., Limited

Featuring . . . .

ARTHUR TREVE HOLMAN, O.B.E., J.P., M.I.Mech.E.

ALTHOUGH Mr. A. T. Holman has only come into prominence in the foundry industry in the last few years because of his pioneer work in the development of dust-extraction attachments to fettling tools, he is very well known in engineering circles. As chairman of the very old-established company of Holman Bros. Limited, of Camborne, Cornwall, he has well maintained and enhanced the reputation of his native county as an engineering centre. His firm operates an iron and steel foundry for supplying the works with castings for the wide range of mining appliances which they make; for many years they have been Meehanite licensees. Mr. Holman, who was born in 1893, was educated at Blundell's School and Birmingham University and supplemented his training by practical experience as an apprentice in the shops at Camborne and at Alfred Herbert Limited, Coventry. He was a member of the Council of the Institution of Mechanical Engineers from 1952 to 1955, but withdrew from further nomination owing to pressure of work in Cornwall. He recently presented a paper of great foundry interest to that body, conjointly with Mr. W. B. Lawrie and Mr. E. B. James. Following that, with the same colleagues, he gave a paper on dust control in the foundry to the London branch of the Institute of British Foundrymen.

During the 1914 war, he served first with B Battery of the H.A.C., then with the Royal Field Artillery, finishing with the Royal Air Force. In the last war, he commanded the 11th Cornwall Battalion of the Home Guard for 4½ years. In 1944, he was appointed an Officer of the British Empire. Service with the Forces is almost a tradition with the Holman family and each of the present seven directors of the company served in either the Navy, the Army or the Air Force. One of his brothers was killed in France in 1914 and his other brother who served with the Army in both wars, died last year. It is also a tradition with the family that support must be given to local activities and Mr. Holman, like his father and mother, is a Justice of the Peace. He was, in 1942 and 1943, High Sheriff of Cornwall and presided over the Cornwall Technical College from its inception in 1928 until the present year. He is vice-chairman of the Camborne School of Metalliferous Mining and is chairman of the Cornish Engines Preservation Society. In connection with the latter, a unique museum of Cornish-made machinery is maintained at Camborne, including a beam engine in working order. As relaxation from business, Mr. Holman concentrates his efforts on gardening and is chairman of the Cornwall Spring Flower Society.

Foundry Plant for Russia

Following the discussions between the Prime Minister, Mr. Bulganin and Mr. Khruschev, a schedule of machinery equipment and ships was submitted representing Russian requirements. Amongst the goods in this which are not affected by the Strategic Export Controls listed by the Foreign Office, and issued by the Board of Trade, are the following items of foundry equipment:—

Automatic four-station moulding machines—up to 140 units; automatic sand-preparing plants—11 units; shell-moulding machines—50 units; automatic coreblowers—up to 300 units; "boxless" moulding machines—up to 140 units; moulding machines in the line—up to 100 units; moulding machines with a capacity of 100 boxes per hour—70 units; coremaking machines—65 units; five-station automatic coreblowing machines—up to 100 units; universal coreblowing machines—up to 130 units; and moulding machines for boxes 5 by 5 ft. (capacity 20 to 40 tons)—20 units.

Luncheons

BRITISH S.G. IRON PRODUCERS' ASSOCIATION

Mr. Philip Russell, who is continuing in the chair for a further year, presided over the annual luncheon of the British S.G. Iron Producers' Association, which was held last week at the Café Royal. Amongst those present were Mr. K. Marshall, Dr. A. B. Everest, Dr. J. G. Pearce, Mr. Colin Gresty, Mr. S. H. Russell, Mr. V. C. Faulkner and Mr. M. Hallett. For his services in the creation of the Association, Mr. Philip Russell was presented with a silver cigarette box by Mr. Gresty on behalf of the members.

BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION

Dr. Maurice Cook presided over the annual luncheon of the British Non-Ferrous Metals Research Association held at the Savoy Hotel, last Thursday. The speakers were Sir Edward Boyle, Bt., M.P. (Economic Secretary to the Treasury), Lord Baillieu, K.B.E., C.M.G., Mr. W. F. Brazener, J.P., and the chairman.

Matters of Some Urgency

Will members of the Institute of British Foundrymen who intend to participate in the annual conference at Cardiff (June 12 to 15), but have not yet made known their wishes to the organizers, please do so immediately. This involves returning completed reply booking forms to Mr. G. Lambert, the general secretary, at the Institute's head office in Manchester, and making hotel bookings independently. Details of the complete programme were published in the JOURNAL, April 5 issue, and this week are printed (facing this page) particulars of the works to be visited. Early applicants will stand the best chance of attending the functions of their first choice, latecomers may be disappointed.

Seats Vacant

There are still vacant places for the works visits organized by the London branch of the Institute of British Foundrymen for May 11. Three works—Morris Singer & Company, Limited (art foundry), with Universal Pattern Company (London), Limited, or APV-Paramount, Limited (steel and non-ferrous foundries), are to be toured. Late applicants should get in touch with the branch secretary (Mr. A. R. Parkes) immediately (charge—including coach, luncheon and gratuities—£1 per head).

Dinner

LAKE & ELLIOT, LIMITED

A dinner was held in the canteen of Lake & Elliot, Limited, on April 10, to celebrate the completion of 30 years' service with the company by the managing director, Mr. C. H. Kain. All departments were represented and the 166 guests included Mr. H. C. Bradbrook, Master of the Worshipful Company of Founders, Mr. J. W. Gardom, past-president of the Institute of British Foundrymen, and Mr. J. C. Simonson and Mr. S. B. Perry, directors of the National Steel Foundry (1914), Limited, of Scotland, now owned by Lake & Elliot, Limited.

Proposing the toast of "The Company," Mr. Bradbrook spoke of the achievements of the company during Mr. Kain's years of service. He also spoke of the high position Mr. Kain had attained in the foundry world by becoming the first chairman of the British Steel Castings Research Association, and by being the recipient of the Oliver Stubbs Medal, the premier award of the Institute of British Foundrymen. He referred further to Mr. Kain's keen interest in technical education as evidenced by his being founder of the Braintree Technical and Arts Institute.

Mr. Kain, in reply, expressed his thanks to all employees for their co-operation during his years of service and for the good spirit fostered in the company, as evidenced by the current employment of 31 sons and five daughters of old employees. Mr. H. K. Yeulett, assistant secretary, was presented with a gold watch in recognition of his 50 years' service, and he in turn presented Mr. Kain with a silver salver, subscribed for by employees of the company.

Council of Ironfoundry Associations

Mr. N. P. Newman, chairman and managing director of Newman, Hender & Company, Limited, ironfounders and valve manufacturers, Woodchester, Glos., has been re-elected as chairman of the Council of Ironfoundry Associations for a further year. Mr. Newman is also president of the Joint Iron Council. Mr. Malcolm J. Glenny, a director of the Dover Engineering Works, Limited, Mr. F. D. Ley, managing director of Ley's Malleable Castings Company, Limited, and Mr. H. V. Shelton, chairman of the British Ironfounders' Association, were re-elected vice-chairmen of the Council, representing, respectively, the engineering, malleable and light-castings sections of the ironfounding industry. Mr. Glenny is president of the National Ironfounding Employers' Federation, and Mr. Shelton is chairman also of the British Bath Manufacturers' Association and the National Light Castings Employers' Federation. Mr. A. E. Pearce, managing director, Midland Motor Cylinder Company, Limited, was re-elected to the executive and finance committee of the Council; Mr. R. Chisholm (Ellerby Foundry, Limited), and Mr. R. L. Handley (Ferranti, Limited), were elected members of the executive committee.

Latest Foundry Statistics

According to the British Bureau of Non-Ferrous Metal Statistics, the production of copper-base castings in February was 6,875 tons. The increase of the first two months of this year over 1955 was 2,504 tons.

A hearty welcome—for the second time within four years—is offered by the Wales & Monmouth branch of the Institute of British Foundrymen and firms in that area to foundrymen all over the country. The new occasion is the Institute's conference to be held in Cardiff this year, from June 12 to 15, and particularly for the series of works visits scheduled in the programme of the final day. To assist intending participants to choose which works out of the twelve they would prefer to visit, the following brief accounts have been prepared—they may also serve to give non-participants an idea of the extent and diversity of the foundry and kindred industries in the South Wales and Monmouth area. The previous series of visits was that organized by the branch for National Works Visits Day in 1952, when nine works were toured by parties of members.* Many of these same works are to "open their doors" again, and it is interesting to observe changes and record progress made in the intervening years.

Northern Aluminium Company, Limited

The Rogerstone plant of Northern Aluminium Company, Limited (see heading block†), though the largest of the company's three works, is at the same time the youngest. The first Noral products were the castings made in the firm's Handsworth foundry in 1926; the Banbury works, which produces sheet, sections, and aluminium paste for paint, started operations in 1931. It was not until 1945 that Northern Aluminium Company acquired the Rogerstone rolling mill and extrusion plant that they had operated throughout the war for the Ministry of Supply, and soon afterwards, the first steps were taken to build the continuous-strip mill that now dominates the site. It was officially opened in 1950.

Capable of producing 50,000 tons of sheet and strip a year, the continuous-strip mill, with its ⅓-mile long "hot" line, is the largest of its kind outside the United States. Building sheet, container sheet for use in the packaging of food, toilet goods and household stores, foil stock, plate, and circles for pressing into domestic holloware, are the commodities generally produced.

Although most of the metal for rolling into sheet comes directly from Canada in the form of 2-ton ingots, a proportion of the slabs is cast in an adjacent remelt department. The four melting furnaces used are of low-frequency induction type, and the metal is held at a steady temperature in electric-resistance-heated furnaces. The slabs for rolling are cast by the so-called continuous process, in which the molten metal runs through a short channel into a water-cooled mould. As the metal fills the shallow mould and solidifies, the floor of the mould is lowered away from the walls, allowing more metal to be poured in. As pouring and lowering are continued, an ingot is produced, its section is that of the mould and its length limited only by the travel of the ram. Ingots for rolling are usually 8-ft. long, 4-ft. wide and 9-in. thick.

With its faces "scalped" by milling to remove roughness, the ingot is pre-heated and moved to the rolling mill, where it passes first through the "breaking-down" and intermediate mills, emerging as a slab about ½-in thick and perhaps 150-ft. long.

*Accounts of these works were printed in the JOURNAL, October 2 and 9, 1952.

†The illustration at the head of this article shows the buildings housing the continuous strip mill at the Rogerstone works of Northern Aluminium Company, Limited, one of those to be visited by members of the Institute of British Foundrymen.

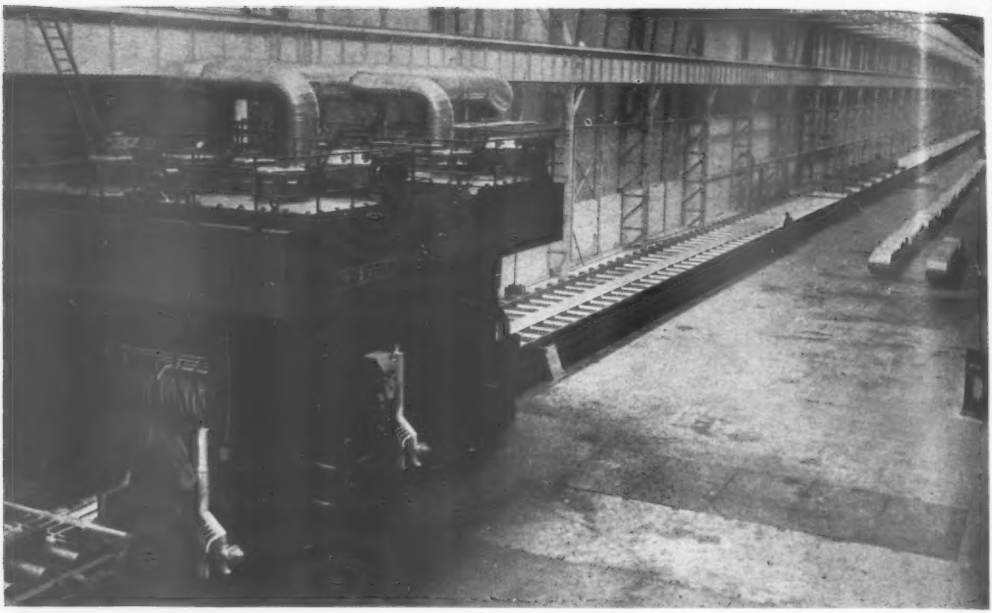


FIG. 1.—*View of the hot-finishing mill and 700-ft. long run-out table at the Northern Aluminium Company, Limited's, Rogerstone plant.*

In one pass through the hot-finishing mill (consisting of two sets of rolls working close together in "tandem") the slab is finally reduced to a strip about $\frac{1}{10}$-in. thick, as much as 200 yards long, and emerging on to the 700-ft. run-out table at 800-ft. per min. (Fig. 1). After coiling, the strip is removed for cold rolling, and further processing (slitting, annealing, temper rolling, or possibly corrugating) according to the final product required. Mechanical handling is an outstanding feature of all operations.

As would be expected, much use is made of aluminium in the plant: its walls and roofs are corrugated aluminium sheet, with foil insulation; ducting, conduit and bus-bars are of aluminium, and ten of the overhead travelling cranes, ranging from 5 to 40 tons in capacity, have light-alloy structures.

Although the continuous strip mill is the most impressive feature of the works, the rolled and extruded products of the older parts of the works still make up a substantial proportion of the output. The ten extrusion presses, which include one of 8,000-ton rating (the largest in this country) turn out about 850 tons a month of light-alloy sections, notable examples being the wing spars for the "Canberra" bomber and "Comet" airliner. Rod and wire are rolled from cast billets in a bar mill capable of handling some 500 tons of metal a month. The employees at Rogerstone number in all about 3,400.

Saunders Valve Company, Limited (Cwmbran Foundry and Goulds Foundries, Limited)

Saunders Valve Company, Limited, is well known throughout the world for its diaphragm valves, aircraft fluid-control equipment and centrifugal pumps, but it is only in the valve works at Cwmbran that we are here concerned.

The site now occupies some 14 acres and a further 60,000 sq. ft. of covered space will be added during the current year.

Foundry

The foundry section consists of patternshop (Fig. 2), coreshop, foundry proper, fettling-shop and annealing plant to produce grey iron, blackheart malleable iron, gunmetal and aluminium pressure-tight castings, ranging from $\frac{1}{2}$ lb. to 4 cwt. Castings are also made for the Safran pump, which is produced at the Wolverhampton works where expansion is also in progress. There is a gas-fired vertical sand dryer and a core-sand mixer fed by a sand elevator, horizontal and vertical bench-type coreblowing machines and hand-core making benches. The coremakers are placed on either side of a steel-band conveyor which feeds the two Acme vertical gas-fired continuous ovens.

The ferrous foundry uses synthetic sand and produces moulds on MacNab straight-draw and Wallwork pin-lift machines, all fed from overhead sand hoppers. The moulds roll away from the machines

by gravity conveyors for continuous pouring in grey iron and the same tracks are used as storage for moulds subsequently to be poured with metal batch-melted in the rotary furnaces (Fig. 3). For grey iron, a cupola is provided and for malleable, a one-ton capacity oil-fired Stein & Atkinson rotary furnace. The poured moulds travel by a slat conveyor to a knock-out station in a specially-constructed bay which also houses the Wheelabrator and mechanized sand-conditioning plant incorporating magnetic separator, rotary screen, storage hoppers and continuous mill. Inspection of castings takes place between the Wheelabrator and the fettling-shop. Annealing is done in a solid-fuel-fired " Beehive " type oven mechanically loaded.

The quality of metal in the cupola and rotary furnace is controlled by a well-equipped foundry laboratory and needless to say, modern methods are used in the control of sand quality to the moulding machines.

Machine-shop

The machine-shop absorbs the whole of the foundry output and is equipped with special-purpose machines for valve components; this, of course, in addition to centre lathes, radial drills, milling machines, capstan lathes and other conventional equipment. Most castings after machining are treated with a rust-preventive process before assembly. Thousands of valves are assembled daily and are subjected to a searching porosity and operating test before they are finally inspected and passed to the packing and despatch bay.

The company trains its own floor moulders and foundry technicians under the terms of their apprentice-training scheme. Lads are given one day per week on which to follow the City & Guilds Course in Foundry Practice.

Hot showers are available near to the foundry and lockers and facilities for drying and changing clothes are immediately adjacent.

Goulds Foundries, Limited

Goulds Foundries, Limited, first made castings over eighty years ago and now supply from the Newport works a wide variety of both grey iron and high-duty (Meehanite) castings for all types of industry. The works comprise jobbing and mechanized foundries equipped with wood and metal patternshops and laboratory. In all, approximately 250 people are employed.

A raw material stockyard serviced by overhead and magnetic crane provides extremely economical handling facilities for both foundries. The jobbing foundry produces castings from a few pounds to two tons and is equipped with two cupolas melting at two tons per hour with a daily melt of about 10 tons. Castings are produced by moulding machine, by impeller rammer with roll-over/pattern-draw machine assistance and by conventional floor moulding. Pouring takes place in two bays, the cupolas being served by overhead gantries. A monorail system is in course of construction for serving subsidiary moulding areas.

Latterly, moulding by the CO_2 Process has almost completely replaced dry- and oil-sand practice. Gas is supplied from a liquifier source and delivered by a 2-in. main to all parts of the foundry. Hand leads, with automatic " push-on " valves are situated at strategic points, moulding boxes being supplied with ancilliary equipment for gassing purposes.

The mechanized foundry also produces grey iron and Meehanite with the majority of castings going to the valve, automobile- and hydraulic-equipment industries. This foundry was designed to produce

FIG. 2.—*Section of the patternshop of the Cwmbran Foundry of Saunders Valve Company, Limited.*

FIG. 3.—*Corner of the Cwmbran Foundry of Saunders Valve Company, Limited, showing a section of the roller conveyor storage-banks for moulds, and in the background, a rotary furnace for batch melting.*

castings from a few ounces to 40 lb. in weight. Coleman jolt/squeeze machines using 16 by 16-in. and 20 by 20-in. box-parts of varying depths produce moulds to be placed on a pallet conveyor with core laying by female labour. The sand supply is by a continuous mill delivering sand by inclined belt to overhead hoppers at the moulding-machine site.

Moulds are poured from monorail-supported ladles, filled from several Roper-type bull ladles. The melt is approximately 31 tons per day from cupolas of 3½ tons per hour rated capacity. Poured-up moulds are knocked off on to a vibrating screen by a pneumatic ram, the conveyor being swept clean afterwards by a specially-constructed plough arm. All hot castings are placed on a pendulum cooling conveyor and delivered to an overhead sorting platform from whence they are fed down a chute to a Wheelabrator. From this site, the castings pass in tote boxes through the first inspection to the fettling shop for grinding and to final inspection and despatch. Providing high-quality castings to a wide range of industries has inevitably led to a large inspection department operating on a basis of quality control, close customer contact, backed up by laboratory service. Destructive and non-destructive testing is carried out, the latter in the form of ultrasonic test apparatus (Fig. 4), which is a most recent and valued acquisition.

A modern ablution block and medical station for works personnel is situated between the two foundries and the company is a founder member of the Meehanite Foundry Training School at Butterley. The whole works are unusually compact, but this does not preclude the use of a fork-lift truck for despatch-bay work and several other arduous tasks.

Richard Thomas & Baldwins, Limited

On the site now occupied by the Landore group of works of Richard Thomas & Baldwins, Limited, in South Wales, Dr. William Siemens built the first open-hearth-type steel furnaces in 1868. The company of Baldwins, Limited was formed in 1902 and this company built the Landore works into a composite organization to serve the maintenance requirements of the various steelworks. In 1926, the blast furnaces, coal washery and coke ovens closed down, and in 1945, the company of Baldwins, Limited was merged into Richard Thomas and Baldwins, Limited. On the opening of the company's foundry at Llanelly, the steel, brass and roll foundries at Landore were closed and foundry production concentrated on ingot moulds and iron castings. The Landore group of works at Swansea consists of two foundries, a modern silica-brick-making plant, a machine-shop and fabricating shop and a wagon-repair works, all of which occupy an area of approximately 50 acres and employ about 820 persons.

Foundries

The two foundries are the ingot-mould foundry and the general-iron-castings foundry; the former specializing in the production of large hematite ingot-moulds and slag ladles, and the latter in jobbing iron-castings and small hematite ingot-moulds (see Figs. 5 to 7).

Ingot Moulds

The ingot-mould foundry covers an area of 75,500 sq. ft. and employs 198 people (73 skilled,

FIG. 4.—*Ultrasonic test apparatus used for non-destructive testing at Goulds Foundries, Limited.*

FIG. 5.—*20-ton slag ladle, 11-ft. 2-in. dia. and 9-ft. 4½-in. deep, produced in the Landore foundry of Richard Thomas & Baldwins, Limited.*

113 unskilled and 12 in the patternshop). The foundry is mechanized and produces grey-iron castings up to 30 tons. The current production is of ingot moulds ranging from 10 to 23 tons, and ladles from 7 to 18 tons, to make up an average weekly total of 950 tons (the record output has been 1,120 tons). Metal is provided from a battery of three cupolas each of 12 to 15 tons per hour capacity, one of which is in operation daily. The sand plant consists of three Augusts' batch-type mills and one Coleman continuous mill from which sand is conveyed to each of the six impeller-rammers. Drying is carried out in eight drying stoves of which five are oil-fired and three gas-fired. The knock-out grid, capable of taking a full week's production, consists of steel rails spanning five troughs under which the conveyor belts run for the removal of stripped sand which, after treatment, is fed back to storage hoppers for re-use. After cooling, the castings are fed through a Wheelabrator to the fettling department, where dressing is carried out by pneumatic chippers and grinders. (A full account of the production in this foundry was published in the Foundry Trade Journal on July 24 and 31, 1952, in a Paper by Mr. J. R. Jones.)

General Iron Castings

The size of the general-iron-castings foundry is 42,000 sq. ft. and employs 133 persons of whom 58 are skilled and 75 unskilled. This is a jobbing foundry, partly mechanized, and capable of producing castings of from 4 to 5 tons. It is designed to produce castings used for maintenance purposes in the blast furnaces, steelworks, sheet and tinplate works of the same company. Castings are also made for kiln cars for the pottery industry, the total output per week being in the region of 300 to 400 tons. Metal is provided from two 10 to 12 ton per hour cupolas which are tapped into ladles in the main bay. The sand plant is semi-mechanized, with two August-Simpson No. 2 mills from which sand is discharged into large skips or conveyed to storage for subsequent use by the two impeller-rammers. There are five drying stoves, one of which was recently built and is now oil-fired; the remaining four are scheduled for rebuilding and conversion to oil-firing. Fettling is carried out in two separate bays, one for general castings and the other for ingot moulds and bottom-plates. Castings requiring machining are dealt with in the firm's own engineering and machine shops.

Silica refractory bricks have been made at Landore for many years, but the existing modern plant was brought into production some six years ago. It has a capacity of 500 to 600 tons of silica refractories per week.

The employees are served by a modern amenities building containing lockers, shower-baths, hand-washing arrangements, etc., and adequate canteen facilities are also provided. At the entrance to the works, an area of about 15 acres of tip land has been levelled to provide excellent sports grounds, giving opportunity for football, cricket, bowls and tennis, with an attractive pavilion.

Brown, Lenox & Company, Limited

Brown, Lenox & Company, Limited, at Pontypridd, celebrate this year the 150th anniversary of the formation of the company. The celebration will commence on June 12 with the official opening of the new works-laboratory and an announcement of a new method of making steel chain and chain cable.

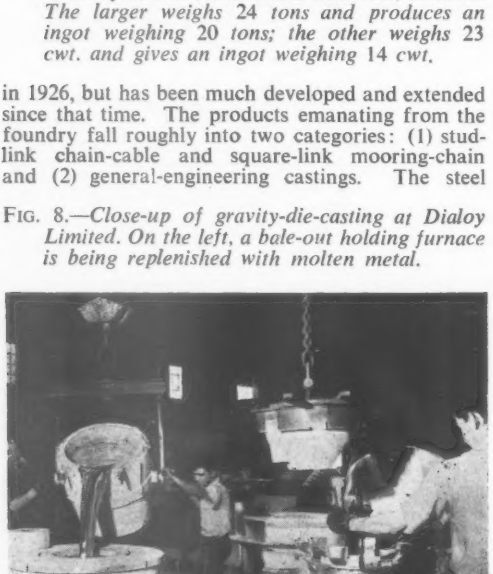
The works cover an area of 653,400 sq. ft. and employ 248 people. The foundry (which produces steel castings from 1 lb. up to 2 tons) was started

FIG. 6.—*A collection of some of the iron castings produced in the R.T.B. jobbing foundry.*

FIG. 7.—*Large and small ingot-moulds manufactured by Richard Thomas & Baldwins, Limited. The larger weighs* 24 *tons and produces an ingot weighing* 20 *tons; the other weighs* 23 *cwt. and gives an ingot weighing* 14 *cwt.*

in 1926, but has been much developed and extended since that time. The products emanating from the foundry fall roughly into two categories: (1) stud-link chain-cable and square-link mooring-chain and (2) general-engineering castings. The steel

FIG. 8.—*Close-up of gravity-die-casting at Dialoy Limited. On the left, a bale-out holding furnace is being replenished with molten metal.*



foundry covers an area of 52,060 sq. ft. and employs 152 personnel of whom 92 are skilled and 60 unskilled. The visiting foundrymen will be interested in the various items of plant used which include sand driers and mills, moulding machines, a coreblower, Wheelabrator and a sand Royer.

The most significant advance that has been made since 1952, is the introduction of 100 per cent. inspection and quality control, made possible by the provision of fully-equipped, up-to-date sand and furnace laboratories on site. The company have a carefully-planned apprenticeship scheme which is worked in conjunction with the Glamorgan Technical College.

Dialoy, Limited

The works of Dialoy, Limited, cover an area of 57,500 sq. ft.; the company was formed in 1946 as a subsidiary of Williams Alexandra Foundry. Initially, the company produced a complete range of aluminium-alloy rainwater goods, together with a variety of other castings for the motor-car and general-engineering industries. In 1946, the staff numbered 25, and about three tons of finished castings were produced each week. To-day, 220 are employed and 25 tons of finished castings are produced weekly. To enable this expansion to be maintained, the foundry has been extended and moved on three occasions and even at present, further extensions are being made to give increased amenities to the workers and to add a further 10,000 sq. ft. to the existing machine-shop capacity.

The foundry, covering an area of 26,500 sq. ft. and employing 175 men, produces about one ton of copper-base castings and 25 tons of light-alloy castings per week, a large part of the output produced being for hydraulic-brake cylinders for the motor-car trade. The foundry undertakes work of a jobbing nature also, up to 5 cwt. individual weight, and produces pressure- and gravity-die-castings up to 10 cwt. (Figs. 8 and 9). The chief items of plant which will be seen by the visiting foundrymen are: Jackman edge-runner sand mill, 37 Morgan bale-out melting furnaces, three Sklenar open-hearth furnaces of 600-lb. capacity, three pressure-die-casting machines (two E.M.B. 10's and one Madison-Kipp 400), four vertical Midsaw band-saws, four pedestal grinders and two Wadkin radial-arm routers in the patternshop. Of the people employed in the foundry, 94 are skilled and 81 unskilled. An apprenticeship scheme has been inaugurated with a view to providing an ample reservoir for skilled labour in the future.

Cardiff Foundry & Engineering Company, Limited

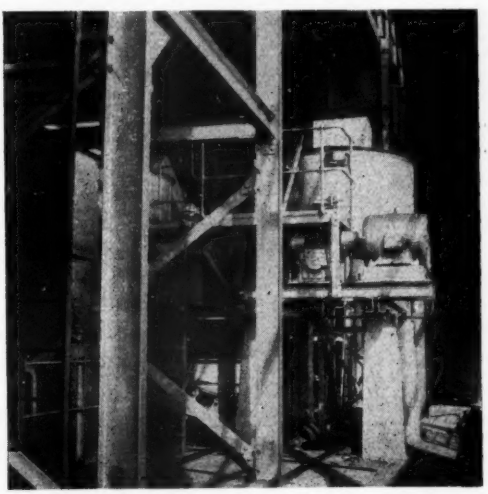
The Cardiff Foundry & Engineering Company (1947), Limited, was acquired by the BSA Tools Group in March, 1947, in order to ensure a continuous supply of machine-tool castings of high quality to their main shops at Mackadown Lane, Birmingham, and other factories in the Tools Group.

FIG. 9.—*General view of the gravity-die-castings foundry of Dialoy, Limited, showing the batteries of bale-out furnaces adjacent to the machines.*

There is a modern iron foundry centrally situated and the works cover a total area of 95,000 sq. ft. and employs over 200 people. The main building is 600 ft. long and 60 ft. wide with annexes running the whole length on both sides. This main bay is split into three sections; the first section for heavy-moulding work, the second mainly for machine-moulding work, and the third contains a mechanized conveyor-unit. The conveyor-unit is made up of 88 casting plates, 4 ft. 6 in. by 2 ft. 6 in., and is served by four jolt/squeeze machines. After ramming, the moulds are placed on the conveyor and travel round to the casting stage and from there to the knock-out, where the completed boxes are pushed off the conveyor by an air-operated ram on to a shake-out grid. In the main bay, there are three electric gantry cranes of 60-ft. span, two with a lifting capacity of 10 tons and one of 5 tons. These traverse the whole length of the foundry, the high roof of which is partly glazed for its entire length and contains seven extractor fans for the circulation of air into the foundry. At night, the main bay of this building is illuminated by 80 lamps each of 750-watt capacity. There are nine moulding machines in the foundry in addition to an impeller rammer which is connected to a large rollover unit having a table 9 ft. by 5 ft. and capable of handling moulds of up to 10 tons in weight. Also in the main bay are seven large mould- and core-drying stoves which are coal-fired by automatic stokers and fitted with thermostatic controls. The main coreshops are contained in the annexes, and in one of these women are employed exclusively in the production of the smaller cores.

The melting units in the foundry consist of three cupolas, two of 2 ft. 6 in. i.d. and one of 2 ft. i.d., the larger ones have a melting rate of approximately three to four tons per hour. These furnaces are charged with an automatic-charging device. This unit is mainly of a conveyor type holding 40

FIG. 10.—*Part of the new sand plant showing one of the elevated mills (Cardiff Foundry & Engineering Company (1947), Limited).*

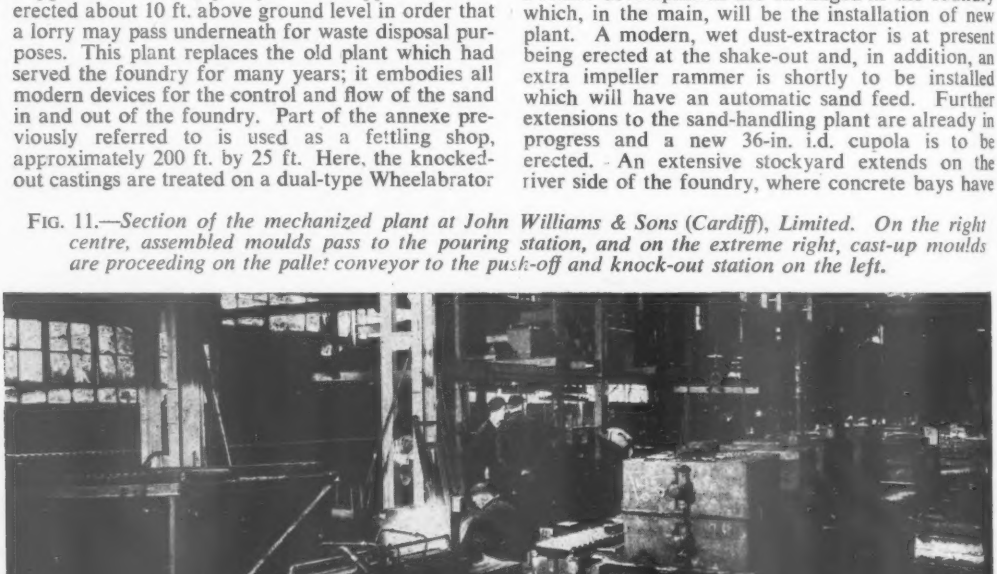


charging buckets each of which are spring loaded. The charges are automatically weighed and on passing in front of the charging hole are tipped up by the operator releasing the catch pins. The main sand plant (Fig. 10), which was recently installed, comprises mainly two large August Simpson mills capable of milling 15 tons of sand per hour. The castings are knocked out on a large grid 10 ft. by 6 ft. The sand is transported underground into a sand house where it is conveyed by elevators and belts into a hopper of 50 tons capacity. Underneath this hopper is a rotary table from which sand can be ploughed off to either mill as required. After milling, the sand is conveyed back again to the foundry by elevated belts on to a large main conveyor belt which extends the whole length of the building. From this, the sand is ploughed off at various points as required. Adjacent to this plant is a special knock-out grid for de-coring castings, here again, sand travels underground into the sand house and from there up an elevator into a hopper of 25 tons capacity. This hopper has been erected about 10 ft. above ground level in order that a lorry may pass underneath for waste disposal purposes. This plant replaces the old plant which had served the foundry for many years; it embodies all modern devices for the control and flow of the sand in and out of the foundry. Part of the annexe previously referred to is used as a fettling shop, approximately 200 ft. by 25 ft. Here, the knocked-out castings are treated on a dual-type Wheelabrator comprising two 6-ft. dia. tables each capable of shotblasting two tons of casting per cycle. Castings are received from there into the fettling shop to be trimmed or ground as required. The grinders in this shop are fitted with an up-to-date dust-extraction unit. Upon completion of fettling, the castings are primer-coated prior to their despatch to the machine shops.

Castings produced are mainly machine-tool castings for automatic machines, lathes, grinding machines, Gridleys, etc., and vary from a few ounces to two tons in weight. The average weekly tonnage is at present 60 tons.

The foundry has a well-equipped laboratory which deals with the sand testing and various metal analyses and both sand and metal are being continuously checked. There is also a large modern patternshop containing machines suitable for the production of both wood and metal patterns. Up-to-date shower-baths, washing facilities and clothes-drying equipment are provided for the employees and, in addition, there is a large canteen and kitchen capable of catering for all personnel. Further developments are envisaged in the foundry which, in the main, will be the installation of new plant. A modern, wet dust-extractor is at present being erected at the shake-out and, in addition, an extra impeller rammer is shortly to be installed which will have an automatic sand feed. Further extensions to the sand-handling plant are already in progress and a new 36-in. i.d. cupola is to be erected. An extensive stockyard extends on the river side of the foundry, where concrete bays have

FIG. 11.—*Section of the mechanized plant at John Williams & Sons (Cardiff), Limited. On the right centre, assembled moulds pass to the pouring station, and on the extreme right, cast-up moulds are proceeding on the pallet conveyor to the push-off and knock-out station on the left.*



been built for the segregation of the various raw materials.

John Williams & Sons (Cardiff), Limited

John Williams & Sons (Cardiff), Limited, have been trading for 108 years and commenced when the great-grandfather of the present managing directors opened an ironmonger's shop and smithy in the centre of the city. The iron foundry is situated on the dock area and has been operating since 1864. At first, the main type of casting produced was for local ship-repairers and steelworks, although contracts were secured for such castings as bollards, which were sent to contractors in many parts of the world. To-day, the foundry employs 160 people out of the total of over 600 in the whole of the company, and all the premises are now in the dock area, the ironmonger's shop having been closed in 1917. In addition to the foundry, the company are well known as iron and steel stockholders, specializing particularly in plates and sections usual for the ship-repairing industry. In normal times, stock of about 4,000 tons is held. In 1889, the company made their first metal windows, and to-day the window factory has an annual output of windows and steel partitions of about 1,600 tons, including about 100,000 windows per year. To cater for the growing demand for galvanized windows, a new hot-dip galvanizing plant was laid down in 1947 and handles also a wide range of other articles. The plant is fired by oil, and the temperature of the metal and the flues is automatically controlled. For many years, the company has also run a construction department, which to-day specializes in welded-plate fabrications, as well as normal structural steelwork.

Foundry

The foundry has for the last 20 years specialized in alloy and high-duty cast irons, such as Ni-Resist, Ni-Hard, Nicrosilal and high-tensile iron, while the normal production of grey iron is a high-quality, low-phosphorus, inoculated material for general engineering purposes. Spheroidal-graphite iron is also produced.

Although the site of the foundry is much the same as over 90 years ago, the premises have been enlarged by the purchase of adjoining property last year, since when the layout has been altered and new plant installed, most of which will be completed by June. The potential output on completion of the alterations will be about 80 tons of castings per week. The range of castings made includes floor-moulded work up to two tons and machine-moulded castings in boxes up to 36 in. sq. The smallest castings made are $\frac{7}{8}$-in. dia. Ni-Hard grinding balls. The foundry alterations have included new sand plant and conveyor (Fig. 11) to serve the moulding machines and additional facilities have also extended the floor-moulding sections. The melting units are acid-lined cupolas and a 10-cwt. rocking-arc furnace. The firm is a member of the Technically Controlled Castings Group.

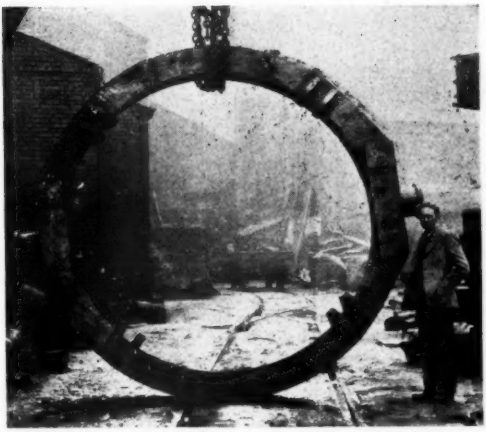


FIG. 12.—*Cast-steel trunnion ring weighing 5-tons 15-cwt. (taking 8-tons of metal to cast) made by the core-assembly method. (Glanmor Foundry Company, Limited.)*

Laboratory facilities for chemical analysis and sand testing have recently been increased and newly housed. The patternshop is on the first floor in the new premises.

Glanmor Foundry Company, Limited

Glanmor Foundry Company, Limited, was formed in 1890, and from the outset specialized in the manufacture of heavy iron and steel castings, the heaviest steel castings produced being over 26-tons finished weight. The foundry was respon-

FIG. 13.—*Mould assembly for a cast-iron bedplate weighing 16-tons, and made in the jobbing section of Glanmor Foundry Company, Limited.*

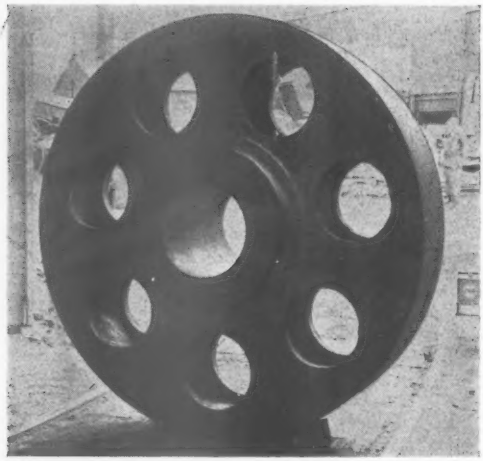


FIG. 14.—*Wheel blank measuring 5-ft. 8-in. o.d. and taking 6½-tons of metal to cast, completed in 36-hrs. at Glanmor Foundry.*

sible for making complete rolling mills, not only for steelworks in this country, but in several foreign countries. In 1939, Glanmor Foundry formed an association with Thomas & Clement, Limited, and the smaller iron castings and all fabricated work are now carried out by this concern. During the last war, extensions were made to the foundry and a modern electric furnace was installed. At the present time, the main production of the foundry is steel castings and the only iron castings produced apart from rolls are those which are too heavy for Thomas and Clement, Limited. The works are fully equipped with its own patternshop and machine shop, both capable of dealing with the largest castings produced. The works at Llanelly cover an area of 196,000-sq. ft. and employ some 275 persons.

Foundry

A large proportion of the work undertaken by the foundry lends itself to production by the core-assembly method which results in an increase in turn-around in the foundry. Considerable development work has been carried out on the CO_2 Process and this, together with the core-assembly method, has made possible great savings in production time and has simplified many jobs and solved a number of problems. The foundry covers an area of 43,200-sq. ft. and employs 144 men (including fettlers) (78 skilled—32 moulders—46 semi-skilled and 20 unskilled). Work mainly of a jobbing nature in addition to rolls is undertaken and up to 100-tons of castings in iron are produced per week, with a similar weight of carbon- and alloy-steel castings. The latter are produced up to 10-tons net weight and iron castings up to about 25 tons.

The chief items of plant which the visiting foundrymen will see are a Birlec electric-arc melting furnace of 3½-tons nominal capacity (charges up to 10-tons 15-cwt. have actually been melted); five moulding machines, one of 1,500-lb. capacity, two of 750-lb. and one each of 300-lb. and 150-lb.; one Acme core-drying stove and seven mould-drying stoves; three annealing furnaces fitted with mechanical charger and quenching tank and one other large annealing furnace; powder-washing equipment; arc-feeding equipment; shotblast plant and a modern sand-drying and -preparation plant. There is also an air furnace for producing rolls and large iron-castings and, of special interest, CO_2 liquifiers connected to a pipeline which services part of the foundry. Unusual jobs undertaken using the core-assembly method are a cast-steel trunnion ring (Fig. 12) weighing 5-tons 15-cwt. (taking 8 tons of metal to cast); a cast-iron bedplate (Fig. 13) and baseplate both weighing 14-tons. the latter measuring approximately 14-ft. sq.

So marked has been the rationalization of processing due to the adoption of new methods, that it is now possible to specialize in supplying replacement castings at short notice in cases of breakdown.

FIG. 15.—*Moulding pits in the drying-cylinder foundry of W. A. Baker & Company, Limited, with a 60-in. dia. cylinder, 183-in. long, in the foreground.*

FIG. 16.—*General view of one of the machining bays in the Engineering Division of W. A. Baker & Company, Limited.*

For example: one wheel blank (Fig. 14), 5-ft. 8-in. o.d. taking 6½-tons of metal to cast, was completed in 36-hrs. with the following time-table:—order received, mid-day; patternmaking commenced—6 p.m. (working through the night); moulding commenced—7 a.m. the following day; job cast at 10 p.m. the same night. The pattern equipment in this case was simply a few segmental coreboxes. Pioneer work on the application of mouldable exothermic-compounds, together with special melting technique, has made possible the production of castings of a weight range which otherwise would have been beyond the capacity of the equipment available.

W. A. Baker & Company, Limited

The works of W. A. Baker & Company, Limited, at Newport, comprise both iron and steel foundries, patternshops, machine shops, and fitting and erection departments. The firm was originally established in 1870. The works cover an area of 14 acres, employ 560, and the principal products are plant and equipment for the paper-making industry, and this absorbs the entire production of the grey-iron foundries, machine and assembly shops, and an appreciable proportion of that of the steel foundry. In association with Black-Clawson Group of companies in this country and the United States, production of a wide and comprehensive range of pulp-preparation plant has been developed and, more recently, the manufacture of board and paper-making machines.

Foundries

The foundries cover approximately 140,000 sq. ft. and employ 220 persons (97 skilled). Fifty tons of cast iron (including Meehanite) and 60 tons of steel (including alloy-steel) castings are produced each week. The finished products govern the type of casting produced and, whilst the maximum use is made of mechanization, it will be immediately apparent that the jobbing type of foundry production is mainly in evidence. The CO_2 Process was introduced into the grey-iron foundry in 1955 and the gas is piped throughout the foundry. Whilst the Process at present supplements loam and dry-sand methods, its application is constantly extending. Castings are produced up to 10 tons in weight and it may be interesting to note that castings up to 4½ tons have been produced, using the CO_2 Process for both moulds and cores. The Meehanite process is used throughout the iron foundries. Electric gantry cranes of 5- and 10-ton capacity comprise the main handling equipment with jib tackle for individual moulding beds. Mould- and core-drying stoves of capacities up to 3,000 cub. ft. and a conveyor unit for small cores form part of the plant, but these units will be reduced considerably consequent upon the extension of the CO_2 Process. An automatic shell-moulding unit operates mainly for the production of castings (in both iron and steel) where the process eliminates, or greatly reduces, the necessity for machining. The recently-opened foundry section for the production of drying cylinders has three circular casting pits, (Fig. 15), 25 ft. deep and 13 ft. dia., with a rectangular pit 18 by 12 by 10 ft. deep. This section is considerably higher than the conventional foundry building, to facilitate the withdrawal and stripping of cylinders, and is designed for the production of cylinders up to 28 ft. long and 60 in. dia., cast vertically, with sectional thickness of 1¼ in. The main equipment is a 10-ton-per-hour cupola fitted with the Equiblast system and a 30-ton crane with an auxiliary 5-ton hoist.

FIG. 17.—*Coke-oven batteries and ram track at the Margam works of the Steel Company of Wales, Limited.*

Steel Foundry.—The steel foundry provides castings of all types to the general trade in addition to carbon- and alloy-steel castings required in the production of paper-making plant. It has a capacity of 80 tons of finished castings per week in weights ranging up to 38 cwt. maximum. Metal is supplied from h.-f. induction furnaces of 12-cwt. and 1-ton capacity and a 2½- to 3-ton direct-arc basic electric furnace. The two units operate independently, but handling facilities allow for easy transfer of the metal from either unit to any part of the foundry.

Other Departments

Moulding and coremaking takes place in three main bays and includes floor moulding, machine moulding and impeller-rammer moulding, respectively. In the latter two bays, backing sands are delivered to moulding stations by overhead conveyors from sand-preparation plants, and each section has underground return of sand. There is one large solid-fuel-fired, and three medium-size gas-fired mould- and core-drying stoves. Normalizing and annealing is carried out in an electric-resistance furnace and two gas-fired furnaces. The CO_2 Process is being introduced into the steel foundry also for some of the work. The range of this foundry is appreciable and current production includes most of the carbon steels and many heat-resisting and stainless steels.

Engineering Section.—This section (Fig. 16) covers an area of some 72,000 sq. ft. and consists of two main bays with adjoining smaller bays for storage of finished parts. Plans for extension include the erection of a further bay 40 ft. wide for the assembly of light units. Four gantry cranes, each of 5-ton capacity, operate in the two production bays and a 15-ton gantry crane is to be installed in the immediate future to handle drying cylinders. Some recent additions to the machine tools employed, include a Waldrick grinder and two Armstrong lathes capable of handling up to 30-ft. face lengths and 60 in. dia. Complete machines are erected and tested in the assembly bay and an appreciable percentage of the total output is shipped overseas.

The ancillary services include a well-equipped laboratory with gamma-ray equipment and full laboratory facilities are available at the Courtybella Works of the Whitehead Iron & Steel Company, Limited, where the most up-to-date and comprehensive equipment is in use for routine and research work.

Steel Company of Wales, Limited

The Steel Company of Wales, Limited, was formed in 1947 when four companies, engaged then in sheet steel and tinplate trade, amalgamated to launch a project designed to revolutionize the industry. To form the company, the founder companies pooled certain of their resources calculated at a value of more than £10 million, including a steel works at Port Talbot and Margam, 18 tinplate works in West Wales and a sheet works at Newport.

Since 1947, the company's plans have been carried out in two stages. The first, initiated between 1947-51, included the reconstruction and enlargement of the blast furnaces, coke ovens (Fig. 17) and coal ore-handling plant at the Margam Works. At the same time, on an adjacent site was constructed the new Abbey Works comprising a new melting shop, 80-in. hot-strip mill, and a three-stand cold-reduction mill.

Most of the main items of plant in the first stage were in production by the end of 1951, and in the following year the company announced the start of the second stage. This included 90 more coke ovens, a new blast furnace (believed to be the largest in Europe), and four more open-hearth furnaces to be installed in the Abbey melting shop. This second stage of the scheme came into production in the early part of 1956, with the exception of two open-hearth furnaces which will start at the end of the year.

When the new plant is in full production the weekly steel output of the whole plant will be in the region of 48,000 tons per week. To achieve this, the four blast furnaces will produce nearly 30,000 tons of iron each week, of which more than 10,000 tons will come from No. 4 furnace alone. Much of the steel strip produced at the Abbey

Works is cold-reduced at the works into sheets for the manufacture of motor-car bodies, metal furniture, refrigerators, etc. A large part of the output of the hot-strip mill also goes to the company's works in West Wales for manufacture into tinplate by the most up-to-date methods.

Guest Keen Iron & Steel Company, Limited

The Dowlais foundry of Guest Keen Iron & Steel Company, Limited, to-day stands on the site of some of the earliest beginnings of the British iron and steel industry. It was in 1729 that a company was first formed to manufacture iron, and by 1780 the first export of iron was made from these works to America. At one time, Dowlais was probably the largest works in the world, giving employment to some 10,000 persons. The business continued to expand up to the end of the first world war when keen competition was being felt from firms with a seaboard site in particular, and therefore, in 1935, the main operations were finally moved to the company's new integrated iron and steel works in Cardiff. The foundry always carried on as an ancillary to the steelworks, continued in Dowlais, and in 1950 a modernization scheme was embarked upon, and this is still in progress.

Iron Foundry

In the iron foundry and fettling shop are employed approximately 170 persons, and these are divided in approximately 50 per cent. skilled and 50 per cent. semi-skilled and unskilled labour. It consists of two bays of 59,000 sq. ft. embodying coreshop and fettling shop. There are five cupolas, four having a normal output of 10 tons per hour; one is used for research. The sand-preparation plant delivers fully prepared sand to any part of the foundry, and has a normal throughput of 6 tons per hour. For larger castings, three impeller rammers are employed.

FIG. 18.—*Large casting for the sugar-refining industry, typical of the jobbing range at Guest Keen Iron & Steel Company's Dowlais foundry.*

The main products of the foundry are, first, ingot moulds, from 30 cwt. to 19 tons in weight, and a normal day's production includes 50 tons of these and 40 tons of bottom-plates. The record make of the foundry was 658 tons in one week, and normal production is over 450 tons per week. In the field of general castings, the foundry mainly concentrates on the heavier types, including large base-plates, colliery winding-drums, and castings for the paper-making and sugar-refining industries, also press parts and large hydraulic cylinders. An example of this type of production is shown in Fig. 18. Normal steelworks castings, including furnace chills and slag ladles made in one piece and weighing 12 tons, are included in the weekly output. There is still a large amount of loam moulding carried out, and it is hoped to encourage the present apprentices to carry on this very skilled type of work.

The patternshop has recently been modernized and the plant now includes a pattern miller and other up-to-date equipment for the production of both wooden and metal patterns and items of foundry equipment.

Non-ferrous Foundry

The non-ferrous foundry produces castings in copper, and all copper-base alloys. They include blast-furnace copper tuyeres, mill bearings, bushes and slipper pads in 48-ton tensile Beta manganese bronze, and solid and cored chill sticks in gunmetal, leaded and phosphor bronzes. Melting units include three oil-fired tilting crucible furnaces of 600, 400 and 250 lb., respectively, and both a 500-lb. and 2-ton capacity reverberatory-type furnace. The drying stove is coke fired and thermostatically controlled.

ACKNOWLEDGMENT

Those who were fortunate enough to make the earlier trip to visit works in this part of the country will well remember the warmth of the reception they were accorded and the coming visit will certainly be well up to the sample, both during the Friday's visits and indeed the whole conference. Early application to the Manchester head office of the Institute for places at the various functions is recommended therefore.

This opportunity is taken on behalf of founders of thanking the various works managements for their further offer of hospitality and also for their help in preparing these accounts of the works and providing illustrations for the JOURNAL.

Notes from the Branches

Wales and Monmouth

Earlier this Spring Mr. J. M. Langham, M.A., visited the Wales and Monmouth branch of the Institute of British Foundrymen to present his Paper entitled "Founding of Marine Propellers" at the Engineers' Institute, Cardiff. This was a diploma-winning Paper originally presented to the London branch and subsequently at the International Foundry Congress at Florence.* A series of lantern slides and a film display of the moulding and casting was also shown. During the discussion which followed, Mr. Langham, in reply to a question, said it was claimed that a five-blade propeller had less vibration in operation than one with a four-blade propeller. He also expressed the opinion that the man-hours entailed in the cement process were not very different from those in loam moulding. Mr. D. Marles moved that a vote of thanks be given Mr. Langham for presenting his Paper so lucidly and with such detail and Mr. Neale seconded the proposal.

On March 6, members of the branch visited the Dowlais works of Guest Keen Iron & Steel Company, Limited, and although it was mid-week there was a good attendance. They were received by Mr. E. M. Yorath, works manager, and Mr. Austin Bevan (this session's president of the branch), and conducted round the works in small parties. The tour included the patternshop, laboratory, and the brass and iron foundries. In the latter, casting was in progress and among other moulds being poured were some 15-ton ingot moulds for the South Wales Steel Works. Great interest was shown by the student members included in the party.

After tea, which was generously provided at the firm's welfare centre, Mr. Wall, honorary secretary, announced that the branch had been presented with a branch president's badge of office, and for this they were indebted to Mr. and Mrs. H. J. V. Williams. He thanked Mr. Williams for this kind and generous gesture on behalf of all branch members. Mr. Williams then invested Mr. Austin Bevan with this emblem of office. A talk followed on the CO_2 Process by Mr. Gordon Jones, who, in his opening remarks, said he preferred not to describe his discourse as a Paper, "but rather an extract from records of his experience in the practice of the CO_2 Process." He dealt with many aspects of the subject, including coremaking and moulding.

Moving a vote of thanks, Mr. Ken Harris said that what Mr. Jones had modestly described as a talk on the Process, had proved to be a most interesting and instructive address. He was sure that all present would agree that listening had been a pleasure and an education. Mr. Brian Douglas, seconding, endorsed Mr. Harris's remarks, and added an appreciation to the firm for their courtesy and hospitality on this occasion.

Lecture Session

The lecture session of the branch was concluded on March 24, when Mr. J. H. Pearce presented a Paper entitled the "Production of Heavy Steel Castings," together with the film "Britain's Heaviest Steel Casting" at the Engineers' Institute, Cardiff. During the subsequent discussion Mr. Pearce very ably dealt with questions, covering details in the making of this stupendous casting. Indeed, it appeared that there were more difficulties to be anticipated in its transport than its manufacture!

* Published in the JOURNAL, September 23, 30 and October 7, 1954

Moving a vote of thanks to the lecturer, Mr. A. H. Cannard referred to the planning and organization necessary in such an undertaking. In an age of mechanization it was a triumph of craftsmanship that the foundry industry could be proud of. The firm concerned were to be congratulated. Mr. D. Gaze seconded, and Mr. Pearce, replying, expressed his appreciation at the reception of his presentation of the Paper and his pleasure at being once more in South Wales.

Annual General Meeting

Earlier in the evening, the annual branch meeting was held, when officers for the coming year were elected as follow:—As *branch president:* Mr. Gordon Rees; as *senior vice-president:* Mr. D. Gaze; as *junior vice-president:* Mr. L. G. Duddridge; as *branch Council members:* Mr. H. S. Exton, Mr. E. C. M. Neale, Mr. D. Marles, Mr. J. V. Faulkner; as *National Council delegates:* Mr. E. C. M. Neale, Mr. Gordon Jones; as *Technical Council representative:* Mr. Austin Bevan; and as *hon. secretary and treasurer:* Mr. A. S. Wall.

Slough

The annual general meeting of the Slough section of the Institute was held on March 20, in the Lecture Theatre, High Duty Alloys, Limited, with Mr. J. Wood in the chair. For the 1956/7 session Mr. A. R. Parkes was elected president, Mr. C. P. J. Flack and Mr. P. Hoesli as senior and junior vice-presidents respectively, and Mr. Hoesli was also re-elected honorary secretary. A new member of the Council elected was Mr. P. R. Gunn, the retiring members being re-elected *en bloc.* The president closed this part of the meeting by expressing the warm appreciation of members to High Duty Alloys, Limited, for the use of the lecture room and other facilities.

Following the annual meeting, there was a talk on "Precision Casting" by Mr. C. F. Widmer, of Close Tolerance Castings, Limited. The speaker surveyed the various precision-investment casting techniques, dealing principally with the Shaw and Investment "X" processes, the latter being an improved version of the lost-wax process method. The relationship between precision investment casting and shell moulding and CO_2 processes was commented upon and economics of investment casting were dealt with briefly. The lecture was richly illustrated with samples of castings and photographs, and considerable well-informed discussion followed its presentation. In conclusion Mr. S. B. Michael and Mr. J. P. P. Jones voiced the appreciation of members.

In the afternoon preceding this meeting, there had been a visit by about 20 members of the section to the precision-investment foundry at Park Royal, London, of D. Napier & Son, Limited, by kind invitation of Mr. G. A. Tomkinson. Here the visitors were divided into two groups for touring the shops and all were much impressed by the high degree of accuracy imparted to the castings and the superlative degree of control applied at every stage of manufacture.

MINERVA DETECTOR COMPANY, LIMITED, announce that their new address is Lower Mortlake Road, Richmond, Surrey. (Telephone: RICHMOND 6431.)

SHEEPBRIDGE STOKES, LIMITED, announce that Mr. R. D. Millar has taken up his appointment as sales representative in the north-western area which includes North Staffs, North Wales, Lancashire, Cheshire and the Lake District as well as Northern Ireland. Mr. Millar will operate from Liverpool Road, Longton, Preston, Lancs.

Association of Bronze & Brass Founders

Business, Technical and Social Meetings in London, April 24 and 25.

The annual meeting of the Association of Bronze & Brass Founders was held on April 25 at the Connaught Rooms, London, Mr. W. T. Hobkirk presiding. Before the formal business of the meeting, the members paid tribute to the memory of Mr. G. F. Mundell, a former president of the Association.

PRESIDENT'S REPORT

The president then gave his Report, in the course of which he said eight new firms had been approved as members of the Association, and continued as follows:—

The last twelve months has been a busy period for the Association and one in which good progress has been made.

Meetings.—The usual quarterly Council meetings have been held and one special meeting, there have been eleven members' meetings in the areas, four meetings of the Main Advisory Committee and ten area Advisory meetings have been held for lectures and discussions. This is apart from the activities of the Technical Committee.

Council.—The Council has been pleased to welcome Mr. E. Ayres who was elected last year and he is proving himself a very valuable member. The loss of Mr. George Mundell was unexpected and a severe blow to us; we regret that owing to his extending commitments Mr. George Hyslop felt obliged to resign as a regular member of the Council, but we are happy that he has been persuaded to continue and so give us the benefit as far as possible of his very great experience both of foundry and association matters. The Council have recommended that the number of members elected should be increased to fifteen so that we can have the benefit of both Mr. Hyslop and Mr. Wormleighton's attendance.

Members' Problems.—During the year members have brought many problems of general interest and on which guidance has been given, these included difficulties due to radiological tests, customers trying to evade payment for packing materials, and credit for rejected castings; these are matters on which a common policy is desirable and which cannot be effective by firms acting alone.

Other Activities.—On a different plane is the work being done by the Association in the Advisory Committee on Welfare, Health and Safety in non-ferrous foundries. Mr. Hyslop has represented the Association on the working party set up by the industry and done great work for the whole of our section of the industry, for which members are profoundly grateful; he has appealed for members to express views on these subjects, as such views will be most helpful at this stage. The Council has examined closely the Clean Air Bill. It appears that the industry may not be greatly affected by the Bill, but it will be necessary to watch the position. Similarly with the Restrictive Practices Bill; as you know, the Association has no price fixing activities, indeed it believes in fair competition, and has nothing to fear from the Bill as at present drafted.

Education

The Association maintains its interest in education and recruitment to the industry, although the area committees set up some years ago have not been active during the year. It is represented on the Board of Governors of the National Foundry College. Mr. W. S. Lawson, who has been the representative since the formation of the Board in 1947, now feels compelled to retire. We are grateful for the many years he has served in this capacity, often attending meetings at great personal inconvenience. The Council has invited Mr. E. J. Brooke to fill the vacancy. The Association hopes to be in evidence at the foundry exhibition to be held in Sheffield in November organized by the National Trades Technical Societies and offers of help from members would be welcome.

Materials.

Supplies of raw materials have not been difficult but they may now be classed as semi-precious metals—with consequent increased difficulties in financing stocks, to say nothing of the credit squeeze. The high prices are due to factors beyond the Association's control, but it has been surprised at the apparently unlimited exports of copper wire beyond the iron curtain and has made a protest about this.

Bulletin.—The *Bulletin* continues to be issued quarterly and is of great help in keeping members informed of the Association's activities and of matters of general interest from many different sources. Mr. W. R. Buxton, who is the editor, in this as well as in many other ways is proving himself a worthy successor to Mr. W. Smithson.

Benefits of Membership

The Association is working for the welfare of the industry by formulating general policies, disseminating information, enabling members to get to know each other better, as in area meetings, and at social functions, such as the one held last night, and so to discuss their problems and promote that interchange of ideas which is so invigorating and valuable, and in undertaking those official representations which to-day are so essential but not so glamorous a feature of an association's work. Of the conditional aid advisory work he would speak later. This work and the other activities which he had mentioned have had the effect of widening the sphere of influence of the work and making the Association better known. This was reflected in the rising membership and the improved finances, both of which are greatly encouraging. It is due to the enthusiasm and hard work of the committees

Association of Bronze & Brass Founders

and representatives and all those who help so generously by giving unstintingly of their time and knowledge. All members can help to accelerate the results by attending the area meetings, speaking of the Association to their friends, and bringing them into the "fold."

TECHNICAL COMMITTEE

Mr. R. Lancaster then presented a report on matters which had been before the Association's Technical Committee. In the course of his statement Mr. Lancaster said:—

During the past year, the Technical Committee had held four meetings, and three meetings of the BSS 1400 Companion Volume sub-committee, also meetings and discussions with the Services inspectorates had been held, and the various representatives had continued their participation in the work of other bodies.

BS 1400:1948.—This subject had been under review for some time and the proposals for revisions and additions to the existing standard would soon be available for comment by industry. This was, of course, the industry's major standard, and the Committee had accordingly given very careful attention to every aspect of the specifications. It wished to see all classes of buyers able to use this standard so that there would be no need for the issue of specifications by other bodies. It had therefore to try to devise specifications acceptable for the various requirements of the Services and industry; the Committee did not believe there was any essential conflict here, but each had special problems which must be recognized and respected. This rather worked against the other objective of reducing the total number of specifications in BS 1400, but the work in hand would, it was hoped, gradually reduce the total number of alloys called for from founders.

He could not go into detail on the proposed specifications, and, moreover, this was not the place and the subject was somewhat *sub judice* pending the publication of the draft by the BSI. It would be found that there were some modifications to both chemical compositions and mechanical properties. The Association would be pleased to have comments in due course, but he assured the members that every detail had had the most careful scrutiny and many had been the subject of most thorough discussion.

Companion Volume.—The British Standard (1400) was intended to give information mainly for inspection purposes. The information was therefore limited and the properties quoted were always conservative. The ABBF Technical Committee had felt that there was the need to provide much more information about these alloys in order to help designers and to encourage the use of the alloys. The Committee had therefore undertaken the preparation of "Companion Booklet, B.S.1400," which would contain articles devoted to the various uses and to the alloy groupings and it was proposed to give, in addition to the specification requirements, mechanical properties much more typical of the alloys. It was felt that the users of casting alloys would appreciate having a booklet containing all this information. The Committee felt sure it would assist founders in selecting the right alloy for a purpose and should contribute towards eliminating some of the troubles which the founder encounters due to the designer having insufficient or misleading information. It was proposed to publish this booklet immediately following the issue of the revised B.S.1400.

Other Matters

Standards for the Motor Industry.—The Committee had noted with interest that the Society of Motor Manufacturers and Traders had re-formed its standards committee and had been in touch with its chairman with a view to co-operating fruitfully with the motor industry on this subject.

International Standards.—The Association was represented by Mr. A. R. French at the meeting of the International Organization for Standardization held in Stockholm in June last. The meeting was called to consider the standards for copper and copper alloys and it was very pleasing to record the good progress made in agreement on casting alloys. The ABBF Committee were concerned, however, that the United States was not represented on this particular committee. It was important that they should participate because of the increasing demand in Europe for United States alloy specifications for defence contracts. The Committee had made strong representations to many bodies concerned and was hopeful that good results would ensue.

Radiological Examination.—The Technical Committee had been requested to consider problems presented by the increasing use of radiological examination. Buyers had, of course, the right to satisfy themselves that castings were sound by this method. The important point was commercial, *i.e.*, founders should satisfy themselves that they were receiving an adequate price for castings subject to this inspection. The Technical Committee would consider preparing some hints on the subject in due course, but were awaiting the publication by the British Standards Institution of work on the terminology of castings defects as revealed by radiography.

Sulphur in Copper-base Alloys.—The Committee had made representations to the oil companies that investigation into the effects of sulphur on cast copper-base alloys should be carried out. This was now of greater importance due to the much higher sulphur content of the heavier oils now being used to a much greater extent for metal melting. There was also interest in the subject because of the limits which were proposed on sulphur content of alloys in the new British Standards specification. The oil companies had not so far felt able to undertake the investigation into the effects on alloys, but they were doing considerable investigation into methods of limiting and reducing the sulphur in their fuel oils. The Committee was happy to state that the

British Non-Ferrous Metals Research Association was to undertake an investigation into the effect of sulphur on certain gunmetals.

Institute of British Foundrymen

The Association was called upon to provide many members of IBF technical sub-committees dealing with non-ferrous castings and the ABBF had felt that such work might be greatly assisted if it was represented on the Institute's Technical Council. Unfortunately it appeared this was not possible owing to the constitution of the Council but the Institute had appointed Mr. G. W. Brown of Newman, Hender & Company, Limited, to represent them on the Association's Technical Committee. Mr. Brown was a member of the IBF Technical Council and in this way liaison was established. The Committee had suggested to the Institute that an investigation into the methods of casting and properies of copper-base-alloy test-bars was a research which they might sponsor. It was felt that such research would throw much light on fundamental properties of the alloys and would be a valuable addition to the knowledge on the subject.

Membership of Committee

During the year, the Committee had the resignations of Mr. E. Wallace of Dewrance & Company, Limited, and Mr. D. H. Potts of Westinghouse Brake & Signal Company, Limited. Both these members had served the Committee well the service which they had given was greatly appreciated. The place of Mr. Wallace has been taken by Mr. H. F. Blandford, of that same company.

Appreciation

The Technical Committee had worked very hard during the past year and deserved the thanks of the Association for the time devoted to its interests. Mr. French had put in an immense amount of work on the sub-committee for BS 1400 revision and Mr. B. R. Higgins and Mr. H. T. Rutter had ably backed him on the main committee. The sub-committee for the Companion Volume to BS 1400, comprising Mr. French, Mr. Higgins, Mr. Mantle, Mr. Robertson, Mr. Rutter and Mr. Wright, had been working very hard under his—Mr. Lancaster's—chairmanship, and he would like to record the valuable work they were doing.

Mr. Mantle had been a very valuable contributor to the work of the Technical Committee. He also thanked the BNFMRA for allowing him (Mr. Mantle) to devote so much valuable time to the work of the Association. Finally, he thanked the secretaries of the Association for the excellent work they had done for the Technical Committee, and for the valuable help given to him personally.

Conditional Aid Advisory Scheme

Next a report on the Conditional Aid advisory scheme was presented in the following form:—

Meetings.—Advisory Service meetings had been held in all areas, at which the subjects of costing, CO_2 Process, metal melting, shell moulding, sand and fuel had been discussed, between October, 1954, and December, 1955—just over twelve months. Three hundred firms had attended 16 meetings and had been represented (182 not being members of the Association) by a total of 498 people.

Applications.—Applications for advice now totalled 27. The most successful of these were requests for help in connection with foundry layout and the Association was grateful for the help Mr. Hudson had given in this connection.

Reports.—The production of the shell-moulding report had been extremely successful. In addition to the knowledge imparted and the discussion aroused, a total of 473 copies had been sold or distributed, several of them to overseas countries. The CO_2 report had just been issued* and this, too, would no doubt be regarded as another successful publication. A second shell-moulding report and a costing report were still awaited. With regard to the latter, the sub-committee which was preparing this document was doing excellent and very complicated work, and their recommendations were looked forward to with interest. Arrangements were being made, with the Board of Trade's approval, for the BNFMRA to produce a further report on melting equipment.

Election of Officers

During the business meeting Mr. W. T. Hobkirk was re-elected president and Mr. Peter B. Higgins vice-president of the Association. The same trustees were appointed as was the membership of Council, except that Mr. Wormleighton was elected, whilst the services of Mr. George Hyslop were still retained.

Social Events

The evening preceding the annual meeting of the Association was devoted to informal social gatherings. A company of members, their ladies and guests, making the total between 80 and 90, assembled for cocktails at the Grosvenor House Hotel, London, and later proceeded by coach to the Theatre Royal to see a light musical play. Upon returning to Grosvenor House, there was supper in the restaurant, with dancing until 1.30 a.m. Official guests at this function included Vice-Admiral M. H. A. Kelsey, C.B., D.S.C., and Mr. Fred Baugh, chairman of the British Bronze & Brass Ingot Manufacturers' Association. No fewer than four past-presidents of the association—Mr. G. T. Hyslop, Mr. F. G. Burrell, O.B.E., Mr. W. R. Marsland and Mr. A. F. Rayner—were present as well as the vice-president, Mr. P. B. Higgins, and most members were accompanied by their ladies. The functions were presided over by Mr. Hobkirk and the complete absence of formality added much to everyone's enjoyment. At the conclusion of the business meetings on the Wednesday, Mr. Hobkirk again took the chair at luncheon in the Connaught Rooms.

* See page 272 of this issue.

Book Reviews

Casting of Steel. Edited by W. C. Newell and published by Pergamon Press Limited, 242, Marylebone Road, London, N.W.1 ; price 5 guineas.

The book consists of 13 chapters each on a specific subject and written by a specialist. The foundry world is short of up-to-date text books of British origin and a new one is therefore examined with much expectancy. It is addressed to those concerned with making steel castings. The first 35 pages are taken up with a technical appraisal of properties of liquid metal and is dealt with mainly from first principles and developed along mathematical lines. The connection, however, between mathematical treatment and the gating systems featured is not clearly shown. On gating systems there is some overlap with the ground covered in chapter 7. A reference to gas content and its effect on flowing power properties (not "fluidity," please) would have been an added attraction.

Chapter 2 on the "Mechanism of Solidification" takes one on an ordered survey of what happens when steel freezes. The subject is given mathematical treatment and is a good review of much published work. At the end of each of these two chapters the reviewer had the feeling of being left in mid-air and would have liked to have seen more positive application of these matters to foundry floor activity.

The next chapter of 55 pages deals with the melting process and is an attractive blend of theory and practice. The impact of the hot-blast cupola on cupola/converter practice is not discussed. Most readers would be grateful for an authoritative declaration on fume extraction and treatment plant for use on arc furnaces. All founders will add "the degree of continuity in operating high-frequency furnaces" as an important feature affecting lining life (see page 120). Surely current practice is almost entirely in the direction of using sheet-steel metal formers rather than asbestos, and of parallel shape, and not tapered as shown in pages 118 and 120? Why is there no mention of low-frequency or mains-frequency furnaces? The chapter, "The Use of Refractories" deals wholly with furnace materials mainly on an academic basis. At the end of it there is a useful presentation on lining materials used in the various melting units.

The 31 pages of chapter 5 are devoted to pattern-making. Far too many pictures of ordinary machines, or unimportant trifles, are included and apart from other issues one would have liked to have read of a consideration of factors involved in incorporating varying rates of contraction in a given pattern to secure a casting correct dimensionally. Metal pattern equipment and techniques receive no attention.

Chapter 6, covering 143 pages, entitled Mould Preparation and Core-making, starts off with a review of sand properties and testing but the latter could be made more specific. Surely the permeability meter designed by the British Cast Iron Research Association (page 196) is not now used. Whilst no mention is made of the "shatter" test, much sound information is included. The statement on the use of silica flour in sand mixtures will doubtless interest H.M. Factory Inspector ! On page 253, the earth-shattering pronouncement is made "Another indispensable tool to the moulder is the trowel . . . Wear and tear varies considerably." As in the previous chapter, there are far too many pictures of moulding machines and other gear. For instance, on pages 254 and 255 there are pictures of chaplets and gaggers. Mould drying by portable driers is considered but reference to an important electrical unit is absent, as is information on the use of the CO_2 Process and rapid-drying core oils. This chapter is really an attempted treatise on moulding and coremaking generally. A critical presentation of the practice, characteristics and needs of steelfoundry moulding and coremaking practices would have been much more profitable.

Chapter 7 deals with some gating and feeding considerations, the effect of casting design on solidity and an excellent review of issues relating to surface defects on steel castings. Centrifugal casting and investment casting are the subjects of chapters 8 and 9 and are dealt with in very informative and readable statements. The metallography and practice of heat-treatment is dealt with in chapter 10 from which the subject is taken to mechanical testing and physical properties (chapter 11). As in certain earlier chapters, there is an excess of unimportant illustration. For instance, six different universal testing machines are shown with two separate pictures of a close-up view of dial indicators. A number of tables of composition and properties of various cast steels are given without a single reference to their BSI specification numbers, which is a startling omission. Intergranular fracture and properties at sub-zero temperatures are not mentioned. Non-destructive testing is dealt with in chapters 12 and 13 and these form an authoritative review of current techniques and applications.

There is one very important and exasperating omission —no consideration is given to the fettling of steel castings. The references stop at 1951 and 1952, and to that extent the book is out of date as regards developments of the last three years. The printing and binding is good. There is a lot of information between the covers but a tremendous amount of pruning could be done in certain chapters, and a more critical approach from the steelfoundry view-point adopted in other chapters. It is regrettable that the fly-leaf and paper cover do not inform the public that the steel-casting section of the British Iron & Steel Research Association was disbanded in 1950. Current research activity is, of course, carried on by the British Steel Casting Research Association under the general direction of Dr. S. J. Sarjant and Dr. A. H. Sully, at Sheffield. It is a book one is just about better off with than without. However, the five guineas necessary to achieve this privileged position will undoubtedly hinder its circulation.

H.W.K.

Survey of the CO_2 Process for Core and Mould Making. An Advisory Service Report by J. L. Rice, B.Met.; published by the Association of Bronze and Brass Founders and the British Non-ferrous Metals Research Association (miscellaneous publication No. 471). Obtainable from the secretaries of the ABBF, 69, Harborne Road, Edgbaston, Birmingham, 15. (Price 5s. to non-members.)

Those readers familiar with Mr. Rice's previous report on shell moulding will be eager to read his views on CO_2 and they will not be disappointed. With his scientific background he is well able to sift the wheat from the chaff, whilst still appreciating the value to be given to practical experience.

Every phase of the Process has been surveyed and reported, and foundries using the Process will be able, quite easily, to compare their own practice with the precepts enunciated, probably to their ultimate benefit. There is much space devoted to gassing and attention is drawn to the use of a mixture of CO_2 and air. As heating usually accelerates chemical action, there would seem to be a case for experimenting with hot-air stoves, which, if well run, should carry more than a modicum of carbon-dioxide. The Report, rightly, does not confine itself to the non-ferrous metals. Quite

(*continued on page 280, foot of column 2*)

Production Moulding of Components for Cast-steel Bogie Trucks*

By J. G. H. Loubser†

At the turn of the century, railway trucks in the United States of America were equipped with bogies on which the main members, viz. the side-frame and bolster, were of a type fabricated of rolled steel and riveted together. This type of bogie is known in South Africa as the "diamond frame-type." The relatively high maintenance costs and frequent failures of the bogies of this design created a field for the development in the USA of cast-steel designs of side frames, bolsters, brake drums, etc., cast in one piece as substitutes for the built-up types. This development was the product of small hard-won gains made over a period of 40 years. The modern steel-truck side-frame cast integrally replaced 27 separate parts previously incorporated in the arch bar-type. The South African Railways were quick to appreciate the inherent advantages to be gained by adopting integrally-cast steel bogies, and in this Paper an account is given of the developments in this field, as pioneered by the Railways' steel foundry at Pretoria.

Introduction

The use of cast steel as a material in this field can be regarded as quite natural, since railroad equipment is subjected to more rough usage than almost any other industrial equipment, and the steel casting with its high resistance to shock, relatively high strength, coupled with toughness and good anti-corrosive properties is the ideal medium for such applications.

In the field of steel castings the railway designer has a wide scope to develop evenly stressed components, with a correspondingly high-endurance limit, which in turn, will give years of trouble-free service. However, the Author would like to stress this point, all these advantages can only be achieved if the steel foundryman is prepared to adopt a scientific moulding, casting and testing procedure when producing such castings. This remark applies particularly to South African conditions. It must be appreciated that in many cases local engineers are adopting well tried-out American railroad designs, where minimum sections, shapes, etc., have been established by trial and error, and scientific accelerated destruction tests. In the United States of America the moulding method was naturally developed in step with such design progress, and consequently scientific use is made of green-sand moulding, chills, feeding heads, ingates, machine moulding, etc., to give a sound casting throughout its section.

In July, 1950, the South African Railways Administration decided, in the interest of the country as a whole, and bearing in mind the serious import restrictions existing at the time, that it was an economic necessity that the integrally cast-steel-truck bogie be manufactured in the Administration's workshops, and the project was handed to the chief mechanical engineer's production planning and development section.

* Paper presented to the South African branch of the Institute of British Foundrymen and reprinted from *Engineer and Foundryman*.

† The Author is engineer in charge of South African Railways.

Planning Programme

The wide and extensive scope of the problem handled by the planning department can briefly be summarized as follows:—

(1) The development of a design of a cast-steel bogie based on American practice, taking due cognizance of local steel foundry limitations, etc., existing at the time. Due consideration had to be extended to the standardization of castings to suit the local wagon stock.

(2) The re-organization and modernizing of the Pretoria steel foundry to meet a demand of at least 120 wagon sets of steel castings per month (*i.e.* 6¼ sets per working day); the proviso being that production had to commence in 1951 and should later be stepped up.

(3) The complete planning of the moulding method in the widest possible sense, *i.e.* from the stage of the pattern and mould design, type of mould, moulding boxes, type of machine moulding, to the shot blast, fettling and final gauging operations.

(4) The final machining operations, naturally, were also part of the project, but these aspects are not dealt with in this Paper.

(5) Introducing the new methods in practice and organizing the production to reach the stipulated maximum.

The project was one of the most difficult and comprehensive that has been handled by the planning department. In the relatively short period of approximately one year a complete foundry reorganization had to be tackled, apart from the development of the moulding set-up, to produce at least 50 large side-frame or bolster castings daily in acid Tropenas converter steel. All this had to be done in the existing foundry building, as only a minor extension to the building was practicable. These large side-frame and bolster castings had not been produced on a production scale in South Africa before, nor was there any foundry literature or "know-how" available on the subject, as the

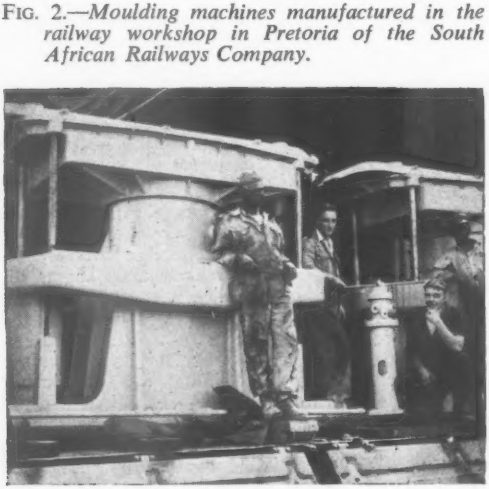
FIG. 1.—*Bogie comprising 15 steel castings, weighing in all 1½ tons.*

production of these castings is usually developed on a "licence" basis controlled by the parent company in the United States of America and "know-how" exchange forms part of such an agreement. The Author had the opportunity to study side-frame and bolster plants overseas in 1952, *i.e.*, after the planned set-up for steel bogies was already in operation in the Pretoria steel foundry, and it was interesting to compare the planned production methods of South Africa with the "standardized" method as developed in the United States of America over a period of years.

Design.—The design of the new bogie and its components was completed in a short time and Fig. 1 shows the general assembly as subsequently fitted to the first trucks to be tested. There are 15 steel castings in each bogie representing a total casting weight of approximately 1½ tons.

The 10- by 5-in. and 11- by 5½-in. journal sizes were selected as the basis of the standard design,

FIG. 2.—*Moulding machines manufactured in the railway workshop in Pretoria of the South African Railways Company.*



and all the casting components for both sizes of bogies, except the two side frames, were of identical design to allow for standardization and to facilitate the moulding and machining operations. Even the side frames were so designed that one central metal pattern on the moulding machine could be used and a 10- by 5-in. or 11- by 5½-in. axle-box pattern could be fitted to suit. The large bolster casting design was "standard" for both journal sizes. The above-mentioned design aspects were introduced to suit South African railway conditions.

Reorganization and Modernization

(*a*) *Converter layout and melting technique.*—In 1948/49 the Pretoria steel foundry was producing 130 tons of fettled steel castings per month. This figure already represented an increase on the previous nominal output of 90 to 100 tons per month, which was considered an uneconomical output for a steel foundry with a covered floor area of 61,500 sq. ft. and a total staff of about 160, even allowing for the fact that the average fettled casting weight was only 30 to 36 lb. and approximately 50 per cent. of the work was of a non-repetitive nature. The foundry was partly mechanized and production work was done on four rollover moulding machines of between 400 and 600 lb. capacity.

The melting plant consisted of two 48-in. cupolas and two Tropenas side-blown converters of an average capacity of 2½ tons of molten steel. At that time, melting could only take place every second day using one converter and allowing the other to be repatched. The number of "blows" per month averaged 82. In order to cope with the bogie castings at a minimum rate of 6¼ wagon sets per day and possible expansion to 10 wagon sets or more per day, it was clear that the melting capacity had to be increased to meet a maximum metal demand of 65 tons per day, *i.e.*, 26 converter blows per day, an output which at that time was only achieved in just over one week. Approximately 20 blows or 46.5 tons of the total daily output of molten steel would then be poured into the bogie casting moulds.

The existing covered melting floor area of 4,375 sq. ft. was considered sufficient for the expansion envisaged, and arrangements were made to instal two 54-in. Whiting cupolas fitted with automatic air-weight control and centrifugal blowers delivering a maximum of 5,400 cub. ft. of air per min. The cupola wells were enlarged to hold 5.6 tons of cast iron. One cupola working daily could, therefore, supply sufficient iron to charge two converters simultaneously. Two 2½-ton converters were manufactured in the railway workshops to the stock Tropenas design and the opportunity used to reposition the converters and standardize all important parts such as the trunnions and tilting gear. Four converters were placed in two rows facing each other so that two "opposite" converters could be used simultaneously while the other two could be patched in position. Two spare converter shells were provided to allow for a quick change should a lining failure occur, or a lining renewal be necessary.

The satisfactory removal of the voluminous converter gases represented a major engineering problem, as the existing method of a fabricated canopy over the converters could only be used where converters were placed near the wall of the building. This was not possible, however, as it was desirable that the overhead crane should be able to run over all four converters. Furthermore, the life of existing canopies was very short and severe warpage and deterioration always set in, with the practical disadvantage that direct changes of converter shells by means of the overhead crane were considered too cumbersome. Thus it was decided to incorporate a new design of canopy as part of the roof.

Controlled experiments were then conducted to establish the arc of the converter flame and metal ejection under various working conditions. The variation in the silicon content of the charged iron was duly considered. The general consensus of opinion at the time was, however, that the proposed arrangement would not function efficiently. In practice, the newly built-in roof canopies proved an immediate success. All the voluminous, brown, converter gases are extracted and in addition the draught created and accelerated by the venturi-effect of the roof canopies is such that the hot surrounding melting-shop air is drawn upwards and a good air circulation is set up, leaving the foundry free of polluted air. Furthermore, the crane movements can now proceed with absolute freedom and converter changes can be made in under one hour.

It would take too much time to describe all the improvements effected. Therefore, bearing in mind that a high quality acid-converter steel using South African raw materials was required, it is the intention only to mention those aspects which have a direct bearing on increased melting capacity and metal quality as specifically required for the large bogie castings.

Experiments were first concentrated on optimum cupola-melting procedure which had to ensure that hot-tapped metal held in a large 6-ton cupola-well should be as low as possible in sulphur content. (The use of a basic-lined cupola was not considered practical at the time.) At peak working conditions the 54-in. cupola had to work at a melting rate of 10½ tons per hr. with a maximum available blower capacity of 5,400 cub. ft. per min. A larger blower capacity of say 6,000 cub. ft. per min. would have been better and could have been effectively used with a 54-in. cupola, using South African coke. It is the opinion that suppliers of cupolas have a general tendency to supply too-low-capacity blowers for South African cupola installations whilst due cognizance is not being taken of the quality of South African coke.

It was established by experiment that the final "blown" steel temperature had to be above 1,720 deg. C. to avoid metal "freezing" or "skull" trouble during the 3-ton ladle transfers and lip-pouring operations. The relatively large number of small, thin-sectioned castings on the floor necessitated high casting temperatures, and caused long pouring delays. In the case of side-frames and bolsters, casting takes place in the range 1,680 to 1,620 deg. C. Lower temperatures causing short runs in the thin axle-box parts and higher temperatures may cause "hot tearing."

The maximum temperature rise obtained during the converter "blow" is of the order 350 to 450 deg. C., with an initial silicon-content range of 1.5 to 1.8 per cent. Thus the cupola operation must be regulated to give tapped metal well above 1,420 deg. C. Special precautions have been taken to use only low-sulphur coke. It should be mentioned that the specification for steel-foundry coke allows

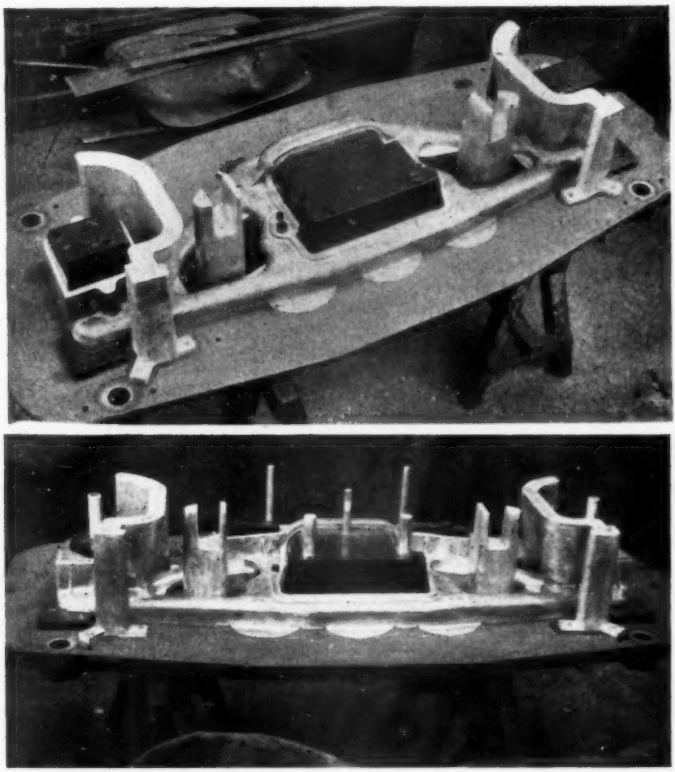


FIG. 3 AND 4.—*Two halves of the pattern for the side-frame casting.*

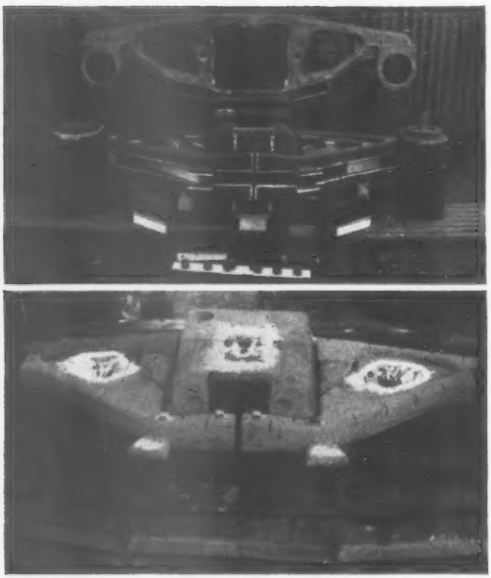


FIG. 5 (ABOVE)—*Core distribution for the side frame, with a casting in the background;* (BELOW) *drag mould cored-up ready for closing.*

an absolute maximum of 1.0 per cent. sulphur only. The normal cupola charge consists of:—400 lb. of steel scrap (foundry returns); 800 lb. of selected steel scrap (low sulphur and phosphor); 800 lb. of Amcor H_2 pig-iron; 25 lb. of fluorspar and 100 lb. of limestone; 380 lb. of coke; and 25 lb. of ferro-silicon (75 per cent. silicon).

It was established that sound side-frame castings free from cracks or "tearing" could only be obtained if the sulphur was kept below 0.035 per cent. This was achieved by an extensive soda-ash treatment of the ladle metal, using a special silica refractory nozzle in the tap hole with a 1½-in. dia. orifice. This expedient now ensures a practically constant metal flow during the day's tapping operations and hence a constant reaction time with the soda-ash. The 1½-in. size of the orifice, obtained by experiment, gives a total tapping time of five to six minutes for 5½ tons of metal. Up to 40 lb. of soda ash is used per ton of cast iron tapped. Half of this amount is shown in the bottom of the transfer ladle and the balance is added to the cupola metal stream two minutes after tapping is commenced, using a specially designed funnel with 3½-in. dia. orifice plate which can be so adjusted that the soda-ash discharge time is approximately two minutes. With this set-up, the usual cupola iron with a nominal sulphur content of 0.085 per cent. after the first tap, is reduced to 0.030 per cent. sulphur or less after soda-ash treatment. Once the "sulphur" problem was solved, the casting of sound side-frames and bolsters was readily achieved.

Converter "Blowing"

The converter "blowing" practice was given scientific attention and numerous experiments were conducted to establish the best "blowing" and melting techniques in order to meet the tremendously increased demand for metal and, above all, to ensure a uniform final product which had to meet the stringent physical requirements laid down. Here, particular attention was paid to causes of low ductility in converter steel and a study was made of the types of inclusions encountered in the steel specimens of low ductility. The publications of Sims, Lilliequist, Dahle and Caine, proved of considerable value as a basis for this investigation. The aluminium additions to the blown metal were increased to 4 lb. per ton to ensure that type III inclusions were present in the treated steel, while silico-manganese was substituted in lieu of ferro-manganese, and small additions of calcium silicide proved very beneficial.

Improvements such as the use of a Carbometer instrument (by which carbon determinations can be made on the melting floor by semi-skilled operators), a suitable crane scale and routine chemical analysis and physical determinations, assisted to place the Tropenas melting practice on a reliable and sound basis.

It is interesting to mention that the melting plant to-day can produce a maximum of 30 "blows," which is equivalent to 75 tons of molten steel, per day. Thus, in three days as much steel can now be melted as was produced in one month prior to the introduction of the reorganization and modernization described.

(*b*) *Development and Organization of Moulding Methods:* It is the intention in this Paper to concentrate on the machine moulding-methods adopted for the side-frame- and bolster-castings. These castings weigh 750 and 800 lb. respectively and are of relatively large dimensions, intricate shape and thin walled.

It was decided to mould the bolster and side-frame and all other casting components in "green" sand, as it was obvious that production of 800-lb. castings, at a minimum rate of 50 boxes of a size approximating to 8-ft. long by 3-ft. wide, could not be satisfactorily handled as a dry-sand proposition. Also, from a moulding point of view green sand offered the desired advantage of easy collapsibility, and hence would reduce "hot-tear" tendencies.

The numerous cores required represented a far more difficult problem, as existing core-oven space was already used to capacity. It was, therefore, decided to devise ways and means to produce cores that could be "air dried," for one or two days, adjacent to the coring-up stations, and then be placed directly in the moulds. (It was subsequently noted that the "standard" American practice is to oven-dry all the lower halves of the wing-cores and then to place these in the core machines and fill up the upper-half of the core in green sand. Thus the dried core acts as carrier for the "coring-up" operation.) Trial experiments were conducted to establish air-drying possibilities and it was found

that a core-sand mixture consisting of a base silica sand, 0.5 to 1.0 per cent. cereal binder, 4 to 5 per cent. Wyoming bentonite and approximately 4 to 5 per cent. of water, gave excellent results, in that cores over one cub. ft. capacity could, under normal weather conditions, be dried sufficiently strong to allow easy handling.

These important basic moulding factors having been established, planning proceeded on the lines of drawing down full-scale mould and pattern drawings and making use, when necessary, of hardboard core cut-outs. The problem was thoroughly discussed and analysed by engineer, patternmaker, moulder, and draughtsman, until the final proposed method of coring and moulding was clearly depicted on the drawing board for the bolster and side-frame. It was decided that both castings had to be produced off the same machine moulding set-up.

In order that all important contemplated production aspects could be clearly visualized individually and as a whole, the following basic factors were calculated for the side-frame and bolster casting on a basis of at least 50 castings per normal shift.

(*a*) Size of moulding-box and weight of box if made in cast iron and steel. (A fabricated box was not favoured due to warping tendency and resultant inaccuracy and high costs.)

(*b*) Approximate size and weight of patternplate.

(*c*) Quantity and type of moulding sand per box and hence per shift.

(*d*) Quantity of core-sand per mould and hence per shift.

(*e*) Number of cores per mould and per shift allowing for the drying cycle.

(*f*) Storage area required for air-drying cycle.

(*g*) Approximate design of core irons and quantity required.

Based on the above-mentioned considerations it was decided that the side-frame and bolster core- and drag-moulds could be produced off a heavy-duty jolt/pin-strip machine having a jolt capacity of at least four tons. Rollover of the box could be achieved by using an overhead electric hoist and a special beam allowing the large moulding boxes to be rolled over on central trunnions.

The acquisition of an impeller-rammer moulding machine was not considered, as it was quite clear that the main problem confronting the planning department was not the production of core- and drag-moulds, but the far more difficult production problems of coring-up, and core production as such in the limited space available in the existing foundry. Based on experience it was estimated that, with an overhead sand-chute, a well designed and efficient jolt/pin-strip machine could produce a side-frame half-mould in under five minutes with no difficulty. This production rate would give a total of more than 100 half-moulds per machine per working shift, and, in the case of the side-frame, using the proposed moulding method, a matter of three thousand-odd cores would have to be manufactured and placed and secured in the mould to keep up with this mould feeding rate. It was, therefore, obvious that the jolt/pin-strip would more than meet requirements. In addition a longer pattern life and lower moulding-machine maintenance would be ensured. The impeller-rammer, in the Author's opinion, only becomes economical when the production rate is such that well over 120 moulds can be produced per shift.

Endeavours to obtain a suitable moulding machine by overseas tender proved disappointing, in that the best promised delivery of a suitable machine was approximately 18 months and the cost over £6,000. It was decided to design and build domestically "tailor made" moulding and core machines specifically to suit side-frame and bolster production. It stands to the credit of the late Mr. L. D. Mitchell that in a matter of two weeks he designed a 14-in. cylinder capacity jolt/pin-strip moulding machine to the following specifications:—Table size 6 ft. × 3 ft. 6 in., maximum load-carrying capacity 8,500 lb. at 80 lb. per sq. in. with a 2⅜ in., "no load," jolting stroke at 200 jolts per minute, the height being 6 ft. 4½ in.

Four of these machines were manufactured in the Administration's workshop at Pietermaritzburg and installed on site in a record time of seven months. These were by far the largest moulding machines ever made in South Africa. Fig. 2 shows the design and size of these moulding machines.

Metal Patterns

Similarly, in view of the relatively large quantity of green-sand cores that had to be handled efficiently, it was decided to design a special jolt/rollover/strip core machine utilizing the standard "South African Railways-type" jolter as rammer. This machine can produce most of the large cores at a fast and hence economical rate. Six of these machines were manufactured in the S.A.R. workshops. All

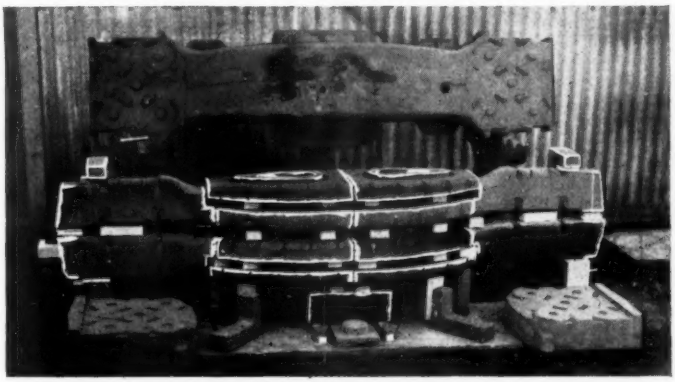


FIG. 6.—*Coring set-up and central ingate for the bolster.*

FIG. 7.—*Cope mould for the bolster casting; the lower illustration shows cores in position.*

the other smaller bogie-casting components could be manufactured successfully on the standard single 7½-in. and twin cylinder 6-in. jolt/pin-strip moulding machines of S.A.R. design. All the moulding machines proved an outstanding success from the outset and have been the very backbone of the bogie production set-up.

The side-frame and bolster patterns were directly made in metal (aluminium/silicon alloy) as this was considered desirable to expedite the start of production. If one considers that this was the first attempt in South Africa to cast these items, it could have been criticized as being unsound, but the risk was considered worth while, as the method of moulding- and core-design had been planned scientifically. Actually these patterns have given good service since 1951 and are now being renewed.

These metal patterns were manufactured in the Administration's patternshop using Universal milling machines and other machine-tool equipment which are operated by patternmakers, who can be considered as patternmakers of both wooden and metal patterns in the widest sense of the word. The Administration has taken the lead in this field and the results achieved so far have fully warranted the capital invested in this new pattern development. Before describing the actual production set-up and sequence of operations in the manufacture of side-frames and bolsters, it is desirable that a brief explanation be given of the method of mould- and core-design adopted.

Side-frame: Contrary to "standard" overseas practice it was decided to mould the side-frame with the machined axle-box-lid face in the drag. This ensured sound metal in the only machined faces on the whole casting. This method also simplifies the location and design of the two axle-box cores proper, and the efficient securing and positioning of the dust-shield pocket core. The pattern was split through the cenre line as shown in Figs. 3 and 4, and mounted on a stress-relieved cast-iron pattern-plate fitted with white-metal pockets for the stripping pin holes. The illustrations show the special pockets designed round the axle-boxes to assist in mould collapsibility and to prevent tearing. These pockets were filled with dry white-sand in such a way that after pouring, the sand could be run out thus allowing contraction freedom. Subsequently it was found that reduction in sulphur content, regulation of pouring temperature, and improved gating would give the same results.

As mentioned before, all the cores, except the thin dust-shield and brake-beam pocket cores, are made in synthetic green-sand. The centre and wing cores are of relatively large section, which represents a departure from overseas practice, where the policy is to split the cores into a larger number of smaller cores. The large-core design represents no production difficulties, as the special type of S.A.R. core machine can satisfactorily cope with these items, a typical example being the "wing" cores of which four halves can be manufactured at a time in one operation. Two core machines can thus "feed" the moulding machines in so far as the supply of the main wing cores are concerned. (Fig. 5.)

The nature of the moulding problems can be appreciated if it is realized that some 30 cores are required per side-frame mould, which, although less than the number used by overseas manufacturers, still means that 1,500 cores must be manufactured, stacked for drying and placed correctly into the mould to meet a daily demand of 50 castings. Cast core-irons are limited to the centre core only, while ordinary bar core-irons are used on all the other cores. The ratio of the mould production to core production times is 1:7.

It will be noted that extensive use is made of thin cooling ribs to obviate hot-tearing. The distribution and design of these ribs was obtained by experiment and was evolved in preference to the extensive use of curved chilling strips which were initially nailed to the cores. The latter method is more expensive and takes more time.

The ingate finally accepted as the best from the point of view of mechanical casting strength and foundry moulding, was a central ingate into the lower leg of the top compression member. It is felt that this method of gating is best suited for the Tropenas acid steel, in that contraction stresses are so balanced that "tearing" and warpage tendencies of the relatively long casting are reduced to a safe limit. This single-control ingate naturally has a strong "washing" tendency, but this erosion action has now been overcome by the use of a special high-refractory sand mixture for a facing round the ingate area. The downgate is designed in such a way as to break the rush of metal.

Careful experimenting, with the size of downgate, ingate design, mould collapsibility, casting temperature, metal composition, the distribution of chills and sand mixtures was necessary in order to obtain a sound casting free from draws, tears and short runs, warpage defects, and one which was within the rigid contraction limits laid down for the distance between axle-box centre-lines. It is interesting to note that in the initial stages of production

the moulds were turned on their sides immediately after casting, to prevent the casting warping, to allow for the knocking out of core centres, and to reduce contraction tearing. The very first trial castings had no less than seven rather bad "tears". To-day casting wasters are, on an average, below three per cent.

Bolster: The bolster is moulded with the top flats vertical and is split centrally. This method, adopted to ensure sound metal in the lower, highly-stressed tension member, is contrary to the general overseas practice of casting the bolster with the flat surfaces in the drag mound. The coring set-up and central ingate is shown in Fig. 6.

The number of cores required per mould is 25, so that for a production of 50 bolsters, 1,250 cores are manufactured and used daily. The ratio of the mould-production time to core-production time is approximately 1:3 and, therefore, the bolster can be produced at a faster rate than the side-frame in

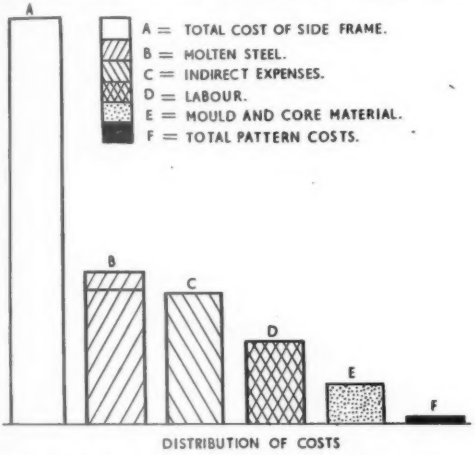


FIG. 8.—*Diagrammatic presentation of the cost of the side-frame.*

the same plant. This fits in well with the production set-up, in that the large bogie centre-castings can be produced on the same 14-in. moulding machines. The layout for the production of the large side-frame, bolster, and bogie centre-castings was designed with due consideration of the fact that foundry space was limited and that the whole production set-up had to fit into the general foundry activity, without disturbing the general flow of work. A relatively compact layout was evolved.

The four 14-in. jolt/strip moulding machines are placed under overhead sand chutes, in deep pits, with the table extending 3½ in. above floor level. Two machines are placed at the one end of the set-up at which station the drag moulds are made, rolled over and transferred by overhead monorail to specially designed low-level mould trolleys moving on 2-ft. gauge track. Only one moulding machine operates at a time and, to facilitate working, the side-frame and bolster patterns are placed on the r.h. and l.h. machines respectively. The trolley with the drag mould is now pushed past the coring-up stations, of which there are three.

Shop Lay-out

The various core racks are so placed that the operators coring-up are spared any excessive handling operations. The heavy cores are handled and placed by means of a light jib crane. All the important cores are placed using special templates. At the far end of the coring-up line, the other two jolt/strip moulding machines produce the cope mould (Fig. 7). The operators at the moulding stations always retain one or two moulds at the back of their machines for replacement purposes in case of a "drop-out" or any other mishap; this ensures a production flow at all times. The core-machines are placed in the area opposite the moulding- and coring-line and cores produced off these machines are air-dried within easy reach.

At the end of the mould and coring line, the copes are closed on to the drags using case-hardened guide pins, which fit into case-hardened bushes metalled into dove-tailed recesses of the cast-steel moulding boxes. The moulds are clamped and the pouring and riser cups placed in position. The daily cast standard test-bar mould is also assembled

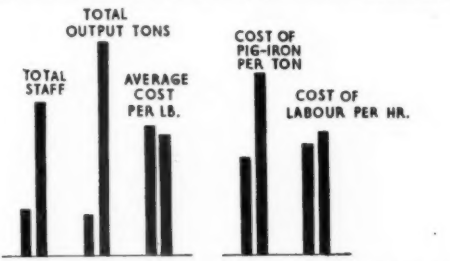


FIG. 9.—*Comparative output of steel foundry of South African Railways before and after re-organization. In each case the* 1948 *value is shown on the left of that for* 1955.

at this stage and placed on a mould for pouring. By means of a traverser the moulds on trolleys are now moved into the casting or pouring line. This line runs the length of the shop up to the mechanical shake-out area, where a six ton shake-out efficiently handles the knocking-out of the large side-frame or bolster moulds weighing up to 3¼ tons each. Knocked-out sand is returned, *via* a conveyor-belt system, to a storage bin supplying two 28-cub. ft. capacity sand mills of the revolving-pan type. The discharge is handled by a scoop truck and fed on to the belt supplying the overhead sand bins, *i.e.* over both the moulding and core machines. The sand-feeding system is so designed that while moulding sand is fed continuously to the overhead bins over the large jolt/strip machines, scoops are so placed that, at fixed intervals, the overhead core-bins can be supplied with special core sand *via* the same moulding sand set-up. The moulding sand is kept to the following physical properties:—

green permeability 180, green strength 7 to 8 lb. per sq. in. and moisture four per cent.

The empty moulding boxes are returned on their trolleys on a second track, up to a traverser feeding the two drag moulding machines. The trolley is transferred to the mould and coring line, while the empty moulding boxes are placed on a roller conveyor situated behind the moulding machines, whereby drag and cope moulding boxes can be delivered to their respective stations.

The knocked-out side-frame and bolster castings are despatched to shot-blast chambers for cleaning and thereafter to the section doing the fettling and gauging. All fettling and gauging operations are done on suitable racks manufactured of rail steel, which allow for easy handling and a convenient working height. An essential and elaborate gauging system has been introduced. On the side-frame alone, over 13 dimensions have to be kept to relatively close tolerances and it is this aspect which calls for a high-production accuracy and extremely strict control. No shifting of cores, etc., is tolerated and castings produced under such circumstances are scrapped. During the fettling operation the side-frames are gauged by a special wheel-base gauge for wheel-base distance, and by chipping off a fixed number of cast-on button heads above the l.h. axle-boxes, the side-frame is grouped within 0.075 inch steps of nominal wheel-base distance. Only a pair of side-frames with the same markings may be used under any one bogie assembly.

Results Surveyed

The magnitude of the moulding activity may best be judged by considering certain production aspects, when, for example, side-frames are produced on the plant at a nominal production rate of 50 castings per shift. On such a shift, 1,500 cores are made and handled, using approximately 1,700 chaplets, 200 chills and 700 sets of core-irons, while some 250 tons of material are shifted round the casting track during a working day. It has been found necessary to have 36 cast-steel moulding boxes in circulation and a separate design has been developed for bolster and side-frames. All moulding boxes have case-hardened bushes and pins and use is made of round and elongated holes in the hole locating system. The bushes are metalled in with aluminium, using jigs to ensure accuracy. Constant checks on this accuracy have been instituted to prevent cross-jointing.

It has been established in practice that the moulding set-up as such, is capable of producing a maximum of 100 castings per working day, provided more floor space, molten steel and shot blast and fettling facilities are allocated to this particular project. However, with the present set-up 20 moulders and core-makers assisted by 36 labouring units are producing, on an average, 50 sound side-frame castings per shift, which gives an average production time of slightly less than 10 minutes for a completed mould. This staff figure includes all the units manufacturing cores, making moulds and coring-up, and the labouring units shifting moulds and handling sand. etc. To date this plant alone in a matter of 2½ years has produced over 21,000 bolster and side-frame castings, whereas the other sections of the steel foundry have produced over 165,000 of the smaller bogie-casting components required for the "Sarcast" bogie.

In conclusion, the Author would like to draw attention to some interesting production cost aspects as established by a detailed cost analysis. In this analysis all factors directly and indirectly affecting the actual costs of production have been given due consideration. The cost of the side-frame is taken as an example and is illustrated diagrammatically in Fig. 8. It will be noted that, although an expensive metal pattern equipment has been manufactured and the life cycle of this equipment is based on four years with normal maintenance attention in between, it is economically sound to invest in expensive pattern equipment. This has always been the policy of the production planning section in dealing with production castings. The actual cost of these castings is well below that of the imported article and the production achieved per man hour compares favourably with overseas production observed by the Author. Fig. 9 shows the favourable effect the general re-organization and the specific introduction of the bogie-casting moulding set-up has had on the output of the steel foundry and the general ecenomic picture of production as such. It will be seen that in the last six years with an increase of staff of approximately 350 per cent. the output has been increased by 520 per cent., while casting costs generally have been lowered by 10 per cent., although raw material and labour costs have increased by approximately 80 per cent. and 12 per cent. respectively.

Book Reviews

(*Continued from p.* 272)

often it brackets the copper alloys with cast iron and then calls attention to the differences which exist, when either the light alloys or steel be under consideration.

A very interesting section deals with the adaptation of the CO_2 Process in a form of shell moulding. Because of strength considerations, CO_2 shells have to be very much thicker than when making resin-bonded "biscuits." The dump box has to be replaced by a frame for ramming-up and the baking by gassing. Finally there is no used-sand recovery.

In the list of 15 advantages of employing the CO_2 Process, which is well thought out, it would appear to the reviewer that there is a major omission, though in a way it is implied—that is, less space is required than for conventional processes. This applies very forcibly when, as in one case, the coreshop was transferred—to occupy but a minimum of space on the moulding floor. This is a major advantage shared with shell moulding, and one Continental foundry is envisaging shell moulding in order to acquire additional manufacturing space.

Of the six disadvantages listed, five may be minimized if not actually overcome, after a few years of practical experience. With number four "no proven means of reclaiming sand is so far available" there is a solution, where the Hydroblast system is already installed. The Report should be acquired by all foundry executives whether or not they practise the Process.

V. C. F.

Company News

COWLISHAW, WALKER & COMPANY, LIMITED—Treasury consent has been received for a proposed one-for-six free scrip issue. Capital is £225,000.

ENFIELD ROLLING MILLS, LIMITED—With exceptional conditions prevailing in 1955, the company reports a record group turnover of £44,000,000 for the year. The group net profit was at a record level of £938,465 (£616,873).

HARLAND & WOLFF, LIMITED—For 1955 the board is consolidating into the dividend the 3 per cent. special bonus paid for each of the two previous years with a recommendation of 10 per cent. on the £4,396,082 ordinary stock.

SANBRA, LIMITED, brassfounders, sanitary engineers, etc., of Birmingham—With a final payment of 10 per cent. the ordinary dividend for 1955 is effectively raised to 13¾ per cent. from 12½ per cent. for 1954, allowing for the one-for-one capitalization issue last May.

BRUSH GROUP, LIMITED—Despite severe competition both at home and abroad, the group achieved in 1955 a considerable increase over the previous year's intake of new orders. This is stated by Sir Ronald Matthews, the chairman, in his review with the full accounts. He adds that the group has a good, well-spread order-book for 1956. The group's output and its position in the export market were well maintained in 1955, but they would have been even more satisfactory if suppliers had been able to fulfil promised delivery dates, the chairman reports.

BEYER, PEACOCK & COMPANY, LIMITED, locomotive engineers, etc., of Manchester—The degree of diversification of the interests of the company achieved to date and the results arising therefrom have more than justified the confidence of the board. Further developments are under consideration at the moment, says Mr. H. Wilmot, the chairman, in his review with the full accounts for 1955. According to first estimates some additional investment in productive equipment will be necessary, he adds, but so far as can be seen will be financed out of the company's current resources.

RATCLIFFS (GREAT BRIDGE), LIMITED,. brassfounders, metal rollers, etc., of Great Bridge, Tipton (Staffs)—The directors have decided not to proceed with the cash issue and to make the scrip issue in voting shares. The first proposal was to make a scrip issue of one 5s. unit and an offer for cash of one 5s. unit, both non-voting ordinary shares, for every four units held. Treasury consent has now been obtained but, the directors state, it is not intended to proceed with the cash issue having regard to the request of the Treasury for the deferment of capital expenditure which is not of urgent importance. The one-for-four scrip issue will be made, but in ordinary shares carrying voting rights.

F. PERKINS, LIMITED, Diesel-engine manufacturers, of Peterborough—Last year the company spent £666,708 on fixed assets, and with further calls on resources to finance an increase in stocks and trade debtors, group cash balances dropped £574,103 to £127,019. With commitments of £729,000 (£808,000), extra finance will be raised in the near future. The board is giving much thought to this problem, says Mr. F. A. Perkins, chairman, in his statement, for while no new capital has been raised since 1951, the turnover has doubled. At nearly £20,000,000, the increase over 1954 is 18 per cent., due wholly to business expansion, for the company's prices have not been increased. Group trading profit, before depreciation, etc., fell from £1,740,149 to £1,301,176.

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

744,471. Northern Aluminium Company, Limited, Bush House, Aldwych, London, W.C.2, and F. Howitt, 13, Church Road, Edgbaston, Birmingham, 15.

A machine for producing light-metal castings of the kind in which several metal dies forming the mould are moved towards and away from one another mechanically. The invention is characterized by means for passing coolant liquid through the dies in order to chill more rapidly a casting poured into the mould. Control is provided for the coolant liquid flow, so as to control automatically the heat absorption effected by the liquid in each casting cycle.

744,523. Specialloid Limited, Black Bull Street, Leeds, 10.

An aluminium-bronze piston-ring, which has been given a hardening heat-treatment (heating at 860 to 910 deg. C. for up to 2 hours), and tempered (by re-heating to 350 to 450 deg. C. and quenching). A typical formula for this aluminium-bronze would be: aluminium 5 to 15, nickel 2 to 8, iron 2 to 8, and manganese 0.25 to 8 per cent. The remainder is copper with or without a small amount (up to 0.25 per cent.) of tin, lead, and/or silicon.

744,596. Ko-We Niederschachtofen, G.m.b.H., Karlsruhe (Baden), Germany.

A method of melting iron-ore in a low-shaft furnace using a blast of air (or air slightly enriched with oxygen). The charge of ore and fuel should contain not more than 5 per cent. by weight of pieces of size above 25 mm. The ore and fuel constituting the charge are mixed before introduction into the top of the furnace, either continuously or in small batches. The invention also provides, *inter alia*, for the heating of the forehearth by gas issuing from the tap hole and for the conversion of the pig-iron into steel on the forehearth. Patent No. **744,655** deals with the design of low-shaft furnaces themselves.

744,598. Osborn Manufacturing Company, 5401, Hamilton Avenue, Cleveland, 14, Ohio, USA.

Core- and mould-making machines, particularly automatic or semi-automatic machines designed to operate continuously through a cycle, including the drawing of the core or mould and delivery of the same from the machine. The machine is described in considerable detail and is illustrated by explanatory drawings. Patent No. **744,656** deals with supports for moulds and the like especially mould-support platens adapted for use in machines described in patent No. 744,598.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

FORMOSA, May 16—Rails, pipes, pipe fittings, and wire ropes, for the Central Trust of China, Purchasing Department, Taiwan. (ESB/9465/56.)

CANADA, May 18—Water-treatment equipment, for the Saskatchewan Power Corporation. (ESB/10008/56.)

SOUTH AFRICA, May 15—Floor grinders, for the Stores Department of the South African Railways. (ESB/10376/56.)

SYRIA, May 9—Switches, terminal boxes, armoured cables, etc., for the President de la Commission des Contrats Exterieurs, Service des Contrats et Marches, Ministry of National Defence, Damascus. (ESB/10571/56.)

Pig-iron and Steel Production

Statistical Summary of January Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the past six months. Table II gives production of steel ingots and castings in January, and Table III, weekly average production of finished steel. Table IV gives the production of pig-iron and ferro-alloys in January, 1956, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	B.o.T. Price Index, 1938 = 100.			Iron-ore output.	Imptd. ore used.	Coke to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	I. & S.	Coal.	Basic materials excl. fuel and food.						Imports.[1]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[2]
1953	260	350	506	304	207	237	215	188	17	339	262	962
1954	263	364	498	299	234	238	229	198	7	356	277	831
1955	276	399	529	311	244	246	240	213	29	381	305	1,183
1955—Aug.[3]	283	423	543	307	244	245	236	189	36	345	256	1,200
Sept. ..	284	424	541	333	247	251	246	224	37	398	329	1,224
Oct. ..	284	425	532	334	249	257	249	225	34	399	332	1,163
Nov.[3]	285	431	532	331	259	261	253	228	36	409	332	1,154
Dec. ..	285	435	539	313	268	261	250	208	35	382	320	1,183
1956—Jan. ..	285	435	537	328	278	270	261	222	38	405	—	1,208

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in January, 1956*

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	4.3	13.7 (basic)	2.2	0.1	19.2	1.1	20.3
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.0	33.7	—	2.5	0.4	36.2	1.4	37.6
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	40.4	—	—	0.1	40.4	0.1	40.5
North-East Coast	0.6	79.0	—	1.3	0.5	79.4	2.0	81.4
Scotland	2.7	38.5	—	2.1	0.4	41.8	1.9	43.7
Staffs., Shrops., Worcs. and Warwick	—	20.2	—	1.4	0.7	20.2	2.1	22.3
S. Wales and Monmouthshire	5.3	83.6	6.7 (basic)	1.1	0.2	96.2	0.7	96.9
Sheffield (incl. small quantity in Manchester) ..	0.6	33.3	—	11.9	0.4	53.2	2.0	55.2
North-West Coast		1.9	4.8 (acid)	0.5	0.1	7.2	0.1	7.3
Total	19.2	334.9	25.2	23.0	2.9	393.8	11.4	405.2
December, 1955	18.3	315.0	24.8	21.0	2.8	370.8	11.1	381.9
January, 1955	20.2	311.0	25.5	20.8	3.1	379.3	10.3	389.6

TABLE III.—*Production of New Non-alloy and Alloy Finished Steel.*

Product.	1954.	1955	1954.	1955.	
			Dec.[3]	Nov.[3]	Dec.
Non-alloy steel:					
Ingots, blooms, billets and slabs[4]	5.1	4.9	4.9	5.4	4.6
Heavy rails ..	9.6	9.4	5.5	10.0	9.2
Sleepers, fishplates and soleplates ..	1.9	2.0	1.8	1.5	3.2
Plates ⅛ in. thick and over ..	47.0	46.1	48.9	48.8	51.0
Other heavy prod.	45.8	47.8	45.0	50.7	47.3
Ferro-concrete bars etc.	5.9	7.0	6.4	8.2	7.2
Wire rods and other rods ..	19.7	22.2	21.2	25.0	23.0
Light rolled prod.	41.2	46.5	43.4	51.0	48.8
Bright steel bars ..	6.3	7.8	6.9	8.3	8.1
Hot-rolled strip ..	21.7	24.1	21.7	25.6	23.3
Cold-rolled strip ..	7.0	8.1	7.2	8.9	8.1
Sheets, incl. coated	38.8	42.7	40.4	45.6	40.2
Tinplate, terne- and blackplate	16.8	17.0	17.5	18.5	16.7
Tubes and pipes ..	20.0	22.9	20.8	25.1	23.7
Tube, pipe fitgs ..	0.4	0.4	0.4	0.5	0.5
Tyres, wheels and axles	4.7	4.8	4.3	5.2	4.7
Forgings (excl. drop forgings) ..	2.6	2.5	2.2	2.5	2.7
Steel castings ..	4.0	4.2	4.5	4.6	4.2
Tool and magnet steel	0.2	0.3	0.2	0.3	0.3
Total	298.7	320.7	306.2	345.7	326.8
Alloy steel	13.2	15.3	13.3	17.3	15.9
Total deliveries from U.K. prod.[5] ..	311.9	336.0	319.5	363.0	342.7
Add: Imported finished steel ..	5.0	18.7	6.2	22.0	26.2
	316.9	354.7	325.7	385.0	368.9
Deduct: Intra-industry conversion[6] ..	41.5	50.4	41.8	54.1	50.2
Total net deliveries of new material ..	275.4	304.3	283.9	330.9	318.7

TABLE IV.—*Production of Pig-iron and Ferro-alloys during January, 1956.*

District	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	26	—	20.7	27.4	1.0	—	49.1
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	7	—	19.2	—	—	1.9	21.1
Yorkshire (excl. N.E. Coast and Sheffield) ..	—	—	—	—	—	—	—
Lincolnshire ..	10	—	39.3	—	—	—	39.3
North-East Coast	21	4.7	49.9	—	—	0.7	55.3
Scotland	9	—	15.6	2.4	—	—	18.0
Staffs., Shrops., Worcs., and Warwick ..	7	—	9.8	1.5	—	—	11.3
S. Wales and Monmouthshire	11	4.8	37.1	—	—	—	41.9
Sheffield ..	2	—	3.5	—	—	—	3.5
North-West Coast	9	20.0	—	0.2	—	1.0	21.2
Total ..	102	29.5	195.1	31.5	1.0	3.6	260.7
December, 1955 ..	101	28.2	186.5	30.8	1.0	3.6	250.1
January, 1955 ..	99	28.5	174.9	28.0	1.2	3.8	236.4

[1] Weekly average of calendar month.

[2] Stocks, mainly ingots and semi-finished, at the end of the years and months shown.

[3] Five weeks, all tables.

[4] Other than for conversion into any other form of finished steel listed.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] Material for conversion into other products also listed in this table.

TWW
foundry supplies
& sundries
MOULDERS' SUNDRIES . FOUNDRY COKES and COAL DUST . PIG IRONS, FOUNDRY and FORGE MOULDING SAND . GANISTER LIMESTONE and FLUORSPAR . BRUSHES, SIEVES and RIDDLES . TONGS, SHANKS and LADLES. These, and all items connected with the Foundry Trade, can be supplied by Ward's FOUNDRY SUPPLIES DEPARTMENT.
★ Write for a copy of our booklet—"Foundry Equipment and Supplies."
THOS. W. WARD LTD · ALBION WORKS · SHEFFIELD
TELEPHONE 26311 (22 LINES) · TELEGRAMS "FORWARD SHEFFIELD"
LONDON OFFICE: BRETTENHAM HOUSE · LANCASTER PLACE · STRAND · W.C.2

F5/29

News in Brief

THIS YEAR the German foundry foremen's association celebrates its fiftieth anniversary.

MOSTON MALLEABLE CASTINGS COMPANY, LIMITED, proposes to build extensions to the foundry at St. Mary's Road, Moston, Manchester.

HILL TOP FOUNDRY, LIMITED, has had plans prepared for the building of a new iron foundry on a site at the rear of Smith Road, West Bromwich.

EDWARDS (BRIGHOUSE), LIMITED, has had plans approved for the erection of extensions to the foundry at Vine Works, Elland Road, Brighouse, Yorkshire.

THE ADDRESS of the Minerva Detector Company, Limited, fire-protection engineers, is now Lower Mortlake Road, Richmond, Surrey (telephone: Richmond 6431).

WHITE BROTHERS, LIMITED, has had plans prepared for the erection of an iron foundry, with amenities block and administration offices, at Durranhill Industrial Estate, Carlisle.

THE LARGEST CONTRACT to be secured by Henry Hope & Sons, Limited, Smethwick, since the war is worth £127,000 and is for fixing all the windows in the new Parliament buildings in Bagdad.

CONSTRUCTION of a three-span steel road bridge at Nassiriyah City, Southern Iraq, is to be undertaken by Dorman Long & Company, Limited, under a contract from the Iraqi Development Board which is valued at £638,895.

NEWTON CHAMBERS & COMPANY, LIMITED, engineers, Thorncliffe, near Sheffield, was toured on Friday, April 27 by 100 final-year students from Loughborough College of Technology. They included many students from overseas.

BRITISH TRANSPORT COMMISSION have placed an order with the Pressed Steel Company, Limited, of Cowley, Oxford, for 403 gangwayed British Railways standard passenger brake vans which will be constructed in the firm's works at Paisley.

PHILIPS ELECTRICAL, LIMITED, Century House, Shaftesbury Avenue, London, W.C.2, announce that their new fluorescent reflector lamps are now available in the 5-ft. 80-w. size. In industry, where dirty atmospheres may seriously reduce the efficiency of a lighting installation, they overcome the necessity for frequent cleaning. The 5-ft. 80-w. tube is available only in the warm-white colour at present.

AT THE CASTLE BROMWICH BIF on April 25, Foundry Equipment, Limited, reported a £60,000 order from a North Country engineering firm for automatic labour-saving plant for its foundry. The firm also sold one of the machines on its stands (worth £1,400) to an Australian buyer. Suffolk Iron Foundry, Limited, of Stowmarket, on the same day reported a £25,000 order from Sweden, and Geo. Salter, Limited, of West Bromwich, received a £20,000 order from Holland.

JAMES BARWELL, LIMITED, Birmingham, has obtained an order from the Layne & Bowler Exports Corporation of Los Angeles, for 50,000 bronze valves for the Teheran Water Department, worth £30,000. It was received personally by Mr. Bryan F. Barwell, from the vice-president of the Corporation, whilst at the Castle Bromwich British Industries Fair. The valves are to be used in a scheme to connect 80,000 houses in the Persian capital; 10 per cent. of the order is to be delivered in six weeks and the remainder over a period of 12 months.

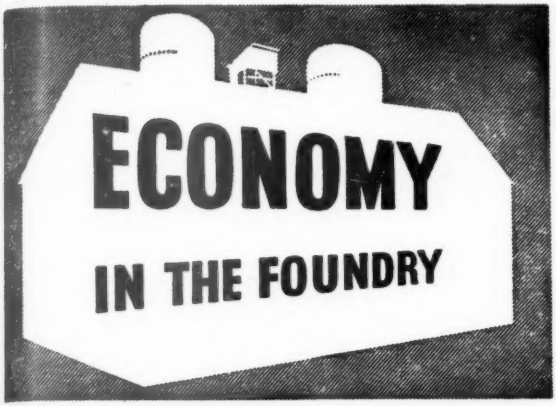
OVER 1,000 selected products are on show in the new centre of the Council of Industrial Design, which was opened in London on April 26 by the Duke of Edinburgh. The new centre, which is in the Haymarket, covers some 8,000 sq. ft. of display space, and is intended to provide home and overseas buyers and other visitors with changing selections of examples of modern British design. About 400 firms are represented in the first selection of goods, which are all in current production. The centre will be open six days a week and admission and services are free.

NEWTON CHAMBERS & COMPANY, LIMITED, engineers, Thorncliffe Works, Chapeltown, near Sheffield, have installed Westminster Chimes mechanism and new works into the Sheffield Moorhead clock, a public landmark in Sheffield for 40 years which is opposite their city showrooms. The chimes were set in motion on April 21, by the Lord Mayor of Sheffield, Alderman J. Curtis, who was introduced by Sir Peter Roberts, M.P., chairman of the company. Mr. J. P. H. Dawson, a descendant of the founder of the firm, Mr. Thomas Chambers, and manager of Newton House, welcomed the guests.

DR. JOHN F. THOMPSON, addressing the shareholders of the International Nickel Company of Canada, Limited, stated that the "consumption of nickel by users in the free world in 1955 was approximately as follows: stainless steels, 30 per cent.; engineering alloy steels, 17 per cent.; high-nickel alloys, 16 per cent.; electro-plating, 15 per cent.; copper-base alloys, 6 per cent.; jet-engine alloys, 5 per cent.; cast irons, 5 per cent.; and industrial chemicals and miscellaneous, 6 per cent. This consumption was fundamentally affected by the abnormal conditions arising through defence and stockpile requirements and inadequate supply."

ABOUT SIXTY WORKERS in the bath-making section of Jackson, Elphick & Company's Alva Foundry, Larkhall, Lanarkshire, have been paid-off, following a decision of the company to close the entire bath-making unit. An official of the firm said that orders for baths had been falling off for some time, and there was a large stock on hand. They were members of Federated Foundries, and all the baths required by the Group would be produced at Barrhead. Other sections of the foundry engaged in making steel and non-ferrous castings will continue in operation, giving employment to about 150 men. It is hoped to extend this work and to build up the labour force of the foundry to the figure it had before the "pay-offs." There is a demand for foundry workers at the present time, and most of the redundant workers have already secured new jobs.

DR. HORACE W. CLARKE, chairman of James Booth & Company, Limited, said at the company's annual meeting in Birmingham on April 25, many people have the impression that when the Restrictive Trade Practices Bill passes into law, prices may be expected to fall considerably. In his view it was likely that they will be disappointed, as the main elements of cost such as metal, labour, fuel and power will not be affected. "It should be noted that, after investigating all phases of the brass and copper fabricating industry, the Monopolies and Restrictive Practices Commission reported, in relation to profits, that the average for the industry as a whole has not been high," Dr. Clarke said. He added that he anticipated a period of some uncertainty which would follow the disbanding of the Trade Associations which have been in existence for so long. He thought that these associations have had a stabilizing influence on the industry to the benefit not only of consumers but to the people employed.



Use

'FULBOND'

TRADE MARK

and reclaim spent sand

For service and information write to:—

THE FULLERS' EARTH UNION LTD.

Patteson Court, Redhill, Surrey. Tel: Redhill 3521. CM/18

LEOPOLD LAZARUS LIMITED

REPEATEDLY PROVEN

INGOTS

IN

BRASS

MANGANESE BRONZE

GUNMETAL PHOSPHOR BRONZE

AND LEAD BRONZE

Members of the British Bronze and Brass Ingot Manufacturers Association.

ON A.I.D. APPROVED LIST

City Wall House, Finsbury Pavement, London, E.C.2. Tel. Metropolitan 8831

Works: St. Stephen's Street, Aston, Birmingham 6. Tel. Aston Cross 3115

Chronicle Buildings, Corporation Street, Manchester 4. Tel. Blackfriars 3741

Powell Duffryn House, Adelaide Street, Swansea. Tel. Swansea 4035

Personal

Mr. L. R. ARMSTRONG has been appointed a director of Catalin, Limited. Mr. Armstrong is also deputy chairman of British Cellophane.

MR. DAVID PETERKIN completed 50 years' service with Albion Motors, Limited, on April 6, and to mark the occasion the directors presented him with a gold watch suitably inscribed.

Mr. WILLIAM MOSEY has been appointed to the board of Le Grand, Sutcliff & Gell, Limited. Mr. D. B. MIRK, chairman, has been appointed managing director in place of Mr. G. V. SIMS, who has retired from the board.

Mr. CHARLES CURY—a well known foundry owner in the Ardennes—has been elected president of the *Association Technique de Fonderie*, and Mr. JEAN LAINE, vice-president. Mr. Lainé is director of the Paris foundry high school.

Mr. D. R. MACKIE has been appointed managing director of Monsanto Chemicals, Limited. Mr. Mackie, who has been acting managing director since November, 1955, was appointed a director of the company in 1952, and commercial director in 1953.

Mr. D. ADAMS, manager of the welding development department of Hadfields, Limited, steelmakers, Sheffield, was presented with a silver-mounted walking stick and £20 on April 20, to mark his 50 years' service with the firm. The presentation was made by Lord Dudley Gordon, chairman of the firm.

MR. RICHARD T. SUTTON, A.M.I.E.E., who joined Lancashire Dynamo & Crypto, Limited, as an apprentice 33 years ago, has been appointed chief engineer of the company's Willesden works in succession to MR. L. E. SAKER, who will continue to be associated with the company in an advisory capacity.

Mr. W. WARING, who recently resigned from the Economic Commission for Europe in which he was director of the Industry Division, has become a director of Brymbo Steel Works, Limited, and later will be appointed a director of Guest Keen Iron & Steel Company, Limited.

The shareholding of J. Stone & Company (Holdings), Limited, in Light-Metal Forgings, Limited has been acquired by Hughes-Johnson Stampings, Limited, and Mr. T. REYNOLDS has been appointed managing director. The forging business was previously jointly controlled by J. Stone & Company (Holdings), Limited, and Hughes-Johnson Stampings, Limited.

Obituary

Mr. T. R. INNES, chairman of the Carmuirs Iron Company, Limited, Falkirk has died at the age of 62. With his business activities he combined duties of an extra-mural lecturer at the Glasgow University, and lecturer at the Scottish College of Commerce, Glasgow.

Mr. VERNON YOUNG, a director of International Combustion (Holdings), Limited, and chairman of its subsidiaries, International Combustion, Limited, International Combustion Products, Limited, and Riley (IC) Products, Limited, died on April 18 at the age of 64. Mr. Young joined the IC organization in 1924 as secretary, a position he held until shortly before his death. He was appointed a director of International Combustion (Holdings) in 1952, and chairman of International Combustion and International Combustion Products in 1955.

Mechanical Handling Exhibition

The Mechanical Handling Exhibition is to be held at Earls Court, London, from May 9 to 19. Much of the new equipment displayed will include cranes, control equipment, conveyors, elevators, stackers and lifters, hoist and pulley blocks, pneumatic handling plants and industrial trucks, all of major interest to founders. A few of the exhibits have been selected for brief comment in what follows:—

CRANE WEIGHERS, enabling goods to be weighed as they are lifted by the crane, will be among the exhibits of Geo. Salter & Company, Limited, of West Bromwich (stand No. 208), and roller bearings will also be shown in various applications.

THE STAND of Martonair, Limited, Richmond, Surrey, will feature pneumatic hoists and hoisting arms; cylinders and control valves; turncock units; and the Servo press. The latter is fitted with a 6-in. dia. air-cylinder with a 4-in. stroke giving maximum pressure of 1 ton with air at 80 lb. per sq. in.

THE GLASGOW FIRM of Mavor & Coulson, Limited, will exhibit on stand No. 123 examples of idlers for belts from 16- to 48-in. wide, and with three or five rollers. Also on show will be their cushion steering and return idlers, the latter including a disc return for sticky or abrasive material or where ice forms on the belt.

NEWMAN INDUSTRIES, LIMITED, of Yate, Bristol, are to show a representative selection of electric motors on their stand No. 7. The exhibits will range from $\frac{1}{6}$-h.p., "Elf" fractional-horsepower motors, to 120-h.p. slip-ring motors, and will include those designed for specific duties such as flameproof, industrial, British Standard dimension, gasworks and pump motors.

A WIDE RANGE of electrically-powered Stacatruc fork-lift trucks and Electricar industrial platform trucks, together with ancillary equipments, will be exhibited by I.T.D., Limited, on stand No. A.101. Latest additions to the firm's range include model 40EH, which is fitted with a rotating clamp; and model 45EH for heavy duty; a new high-lift Portapal pallet transporter will also be on show.

GEORGE COHEN SONS & COMPANY, LIMITED, have reserved two stands at the exhibition. The first of these, stand No. 77, will be devoted to the range of Jones mobile cranes, and the second stand No. 259, will show a representative selection of handling equipment. New machines to be seen include the 3-ton capacity Jones KL.33 crane and a new version of the KL.66. Fork-lift trucks will be represented by the Stacatruc.

THE DISPLAY of Babcock & Wilcox, Limited, draws attention to the activities of their recently-formed materials-handling division, which co-ordinates the work previously carried out by a number of separate departments. Photographic displays show typical examples of the wide range of handling plant manufactured, which include oil-filled conveyor belt idlers and a working model of a rotary hopper for handling wet slurry. Three examples of buckets for gravity bucket conveyors are shown, two representing formed-and-welded construction in steel and in aluminium alloy. The third, a casting in "Hydronalium," has been removed from service at Staythorpe power station, for exhibition purposes. It has been in service since 1950 and has, since then, handled some 2,400 tons of coal.

A date for the diary of *everyone* in production engineering—the most comprehensive show yet seen in this country of the newest, finest, British, European and American machine tools and allied equipment! Study and compare at first hand the world's fastest, most accurate, most economical tools. See them working. Discuss their application to *your* industry, discuss *your* problems with the world's foremost production experts—it's Europe's most important engineering event this year. Don't miss it.

INTERNATIONAL MACHINE TOOL EXHIBITION 1956

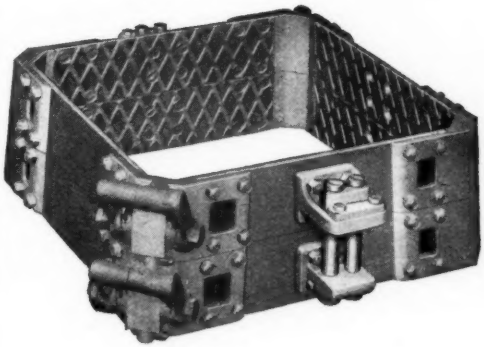
Olympia London · June 22-July 6

Exhibition open daily (Sundays excepted) 9.30 a.m. to 6 p.m. Admission 3/6d. Exhibits include machine tools, engineers' small tools, gauges and measuring equipment, testing equipment, presses and power hammers, heat-treatment plant, woodworking machinery.

Organized by The Machine Tool Trades Association, Victoria House, Southampton Row, London, W.C.1.

W. J. Hooker's Revised

EXTENDIBLE TAPERED SLIP-OFF MOULDING FLASK



The type of Moulding Flask which the Productivity Teams referred to in their reports after visiting America.

- These Flasks can be supplied with the DOUBLE PINS as illustrated or with the usual single pins. THIS IS AN ENTIRELY NEW FEATURE.
- The size of the Flask can be changed at will.
- They are light, strong and easily handled.
- Can be stored flat in your works eliminating the need to stack your moulding boxes out in the open on valuable space.

Cut this out and send for free leaflet describing Hooker's SLIP-OFF FLASKS.

Name. .....

Address .....

.....

W. J. HOOKER LTD.

239a Finchley Road, London, N.W.3.

Telephone: Swiss Cottage 3201/2/3

Raw Material Markets

Iron and Steel

Deliveries of basic pig-iron and hematite to the steelworks and low- and medium-phosphorus iron to the engineering and speciality foundries are maintained and users of high-phosphorus iron, including the light, jobbing, and textile foundries as well as some of the engineering foundries, continue to receive the specified tonnages. In the case of high-phosphorus iron, a furnace in the Derbyshire area is now closed for relining and repairs, which are expected to take about three months to complete. It has also been necessary to switch over other furnaces from the production of high-phosphorus iron to basic steelmaking pig-iron, due to a breakdown of a large furnace at one of the steelworks. This will reduce considerably the overall output of high-phosphoric iron. It is hoped that current needs will be met, but it will be extremely difficult to meet any appreciable expansion in demand should this arise. Some of the light foundries are now a little busier and more orders are being placed to augment depleted stocks of pig-iron. The jobbing foundries are fairly busy and are taking up good supplies, and a fair tonnage is also being sent to the textile and some of the engineering foundries.

The engineering foundries catering chiefly for the motor industry are feeling the effects of the reduced demands for castings from that trade; some, in fact, have resorted to a four-day working week as a temporary measure. Many of the engineering speciality foundries, however, have good order-books and are taking up full supplies of the low- and medium-phosphorus irons. Good quantities of hematite are also being absorbed.

Arisings of heavy cast-iron and machinery scrap are readily accepted. Foundry coke is coming forward in sufficient quantities to satisfy consumption, while ganister, limestone, and firebricks are received to requirements. Following the increase in freight charges, an adjustment has been made in the price of foundry coke of 3d. per ton, with effect from April 23; in addition, 5 per cent. is added to the railway rate. Furnace heating coke was also advanced in price as from April 23 by 10d. to 3s. 4d. per ton according to destination. The summer price differential operates from April 23 to August 31 and this represents a reduction of 7s. 6d. per ton from the basis price. In view of heavier costs, other than the advance in railway rates, prices of pig-iron and steel may shortly be adjusted.

With somewhat improved outputs among the re-rollers, steel semis are being used up more rapidly and stocks have fallen. It seems impossible for home makers to step up supplies and it is hoped that more billets will be imported. The re-rollers have heavy commitments for all their products; numerous orders are on hand for small bars, light sections, and strip, mostly for home consumption, while fresh business is plentiful. At present, only a small proportion of the large amount of overseas business can be accepted. The labour position shows continued improvement

Non-ferrous Metals

The expected drop in the Rhodesian Selection Trust's fixed copper price to United Kingdom consumers came into effect on Monday. The old price of £385 a ton has given way to a level of £350 to bring the quotation into closer relationship with the London Metal Exchange price. The effect, however, has been a further fall in London, a trend emphasized by the contraction of both the producers' and Custom smelters' price in the United States to 46 cents a pound, equivalent to £368 a ton. On Tuesday Custom smelters were reported to be quoting 45 cents. A possibility of a further lowering of the US price cannot be ruled out and a reversion to the old level of 43 cents has been suggested, which, at the equivalent of £344 a ton, would be more or less in keeping with the LME quotation.

Nevertheless, buyers are still holding off on both sides of the Atlantic, even at present prices. The present price slide would seem to have been too precipitous and a reaction, albeit only temporary, may well set in any day, as consumers must come into the market shortly. No. 2 copper scrap has followed the general downward trend and in the States it is being offered at 36½ cents. From Luderitz, in south-west Africa, it is announced that in the southern part of the territory the Lorelei Copper Mines has shipped overseas the first 50 tons of copper concentrates, and a new producer has been opened in Kenya.

The tin market has been disturbed by the threatened dock strike in Penang, which has tended to impart some strength to the market, but it appears to be indifferent to the implications of an actual strike. Consumer buying in the States is keeping the price more or less steady around 98 cents per pound, while the tinplate industry continues to operate at full capacity, with some consumers reported to be sold out as far ahead as the third quarter of this year.

The lead market remains unimpressive, with the London price still tending downwards. In the US buying is steady. Demand for zinc is still good, but the price structure is not strong and the metal continues to weaken in sympathy with the others. Current demand, however, indicates that although zinc may not be able to withstand continued weakness in the other markets, the price decline will not be so great.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* April 26, £350 to £350 10s.; April 27, £350 to £351; April 30, £343 10s. to £344; May 1, £337 10s. to £338; May 2, £345 11s. to £346.

Three Months: April 26, £344 10s. to £345; April 27, £344 10s. to £345; April 30, £337 10s. to £338; May 1, £332 to £332 10s.; May 2, £339 10s. to £340.

TIN, Standard—*Cash:* April 26, £749 to £750; April 27, £760 to £761; April 30, £750 to £751; May 1, £750 10s. to £751; May 2, £752 to £753.

Three Months: April 26, £748 to £749; April 27, £757 10s. to £758; April 30, £747 to £748; May 1, £747 10s. to £748 10s.; May 2, £749 10s. to £750.

LEAD—*Second half April:* April 26, £110 10s. to £111; April 27, £111 10s. to £111 15s.; April 30, £112 to £112 5s. *First half May:* May 1, £111 10s. to £111 15s.; May 2, £112 to £112 5s.

Second half July: April 26, £110 to £110 5s.; April 27, £110 15s. to £111; April 30, £111 10s. to £111 15s. *First half August:* May 1, £110 15s. to £111; May 2, £111 5s. to £111 10s.

ZINC—*Second half April:* April 26, £96 to £96 5s.; April 27, £96 5s. to £96 15s.; April 30, £97 to £97 10s. *First half May:* May 1, £96 5s. to £96 15s.; May 2, £97 to £97 5s.

Second half July: April 26, £94 15s. to £95; April 27, £95 5s. to £95 10s.; April 30, £95 15s. to £96. *First half August:* May 1, £95 5s. to £95 10s.; May 2, £95 15s. to £96.

first— **W20 to increase output**

then— **W42 to minimise casting odour**

Now **the lowest priced urea resin corebinder on the market**

W45

Never before has the Foundry Industry been offered such a high quality corebinding resin at such a reasonable price. Beetle W45 has all the excellent and well-known properties of W20 but offers substantial new economies in use. It is backed by the comprehensive B.I.P. Service that applies to all B.I.P. products.

BEETLE FOUNDRY RESINS

Corebinders and Coregums

B·I·P **B.I.P. CHEMICALS LTD · Oldbury · Birmingham**

Telephone: Broadwell 2061

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

May 2, 1956

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £17 1s. 0d.; Birmingham, £16 13s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £19 8s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £19 8s. 3d.

Scotch Iron.—No. 3 foundry, £19 13s. 0d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £21 9s. 0d.; South Zone, £21 11s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £22 6s. 6d.; South Zone, £22 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. of England (local iron), £20 2s. 6d.; Scotland (Scotch iron), Zone S. 1, £20 9s. 0d.; Sheffield, £21 9s. 6d.; Birmingham, £21 17s. 0d.; Wales (Welsh iron), £20 9s. 0d.

Basic Pig-iron.—£17 8s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £45 15s. 0d. to £47 15s. 0d., scale 15s. 0d. to 16s. 9d. per unit ; 75 per cent Si, £68 0s. 0d. to £71 0s. 0d., scale 16s. 0d. to 16s. 9d. per unit.

Ferro-vanadium.—50/60 per cent., 27s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £240 0s. 0d.; 38/40 per cent., £289 0s. 0d.

Ferro-tungsten.—80/85 per cent., 18s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 21s. 0d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent.C, £88 10s. 0d. to £95 0s. 0d., basis 60 per cent. Cr, scale 28s. 0d. to 32s. 0d. per unit; over 6 per cent. C, £87 10s. 0d. to £93 0s. 0d., basis 60 per cent. Cr, scale 28s. 0d. to 32s. 0d. per unit; 2 per cent. C,* 2s. 1d. per lb. Cr; 1 per cent. C,* 2s. 1¼d. per lb. Cr; 0.15 per cent. C,* 2s. 2¼d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £249 0s. 0d.; 96/98 per cent., £269 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 24s. to 25s. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £59 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £26 19s. 0d.; tested, 0.08 to 0.25 per cent. C, £27 19s. 0d.; hard (0.41 to 0.60 per cent. C), £29 5s. 6d.; silico-manganese, £37 12s. 6d.; free-cutting, £31 0s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £34 12s. 0d., silico-manganese, £36 12s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £32 11s. 0d.; basic, hard, over 0.41 up to 0.60 per cent., C, £33 13s. 6d.; acid, up to 0.25 per cent. C, £36 12s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £33 1s. 6d.; boiler plates (N.-E. Coast), £35 11s. 6d.; floor plates (N.-E. Coast), £34 10s. 6d.; sectional material, N.-E. Coast, £30 19s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £34 7s. 0d.; flats, 5 in. wide and under, £34 7s. 0d.; hoop and strip, £35 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £36 5s. 0d.; black sheets (hand mill), 17/20 g., £46 13s. 6d.; galvanized corrugated sheets, 24 g., £59 5s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £58 0s. 3d.; nickel-chrome, £81 10s. 0d.; nickel-chrome-molybdenum; £92 7s. 6d.

NON-FERROUS METALS

Copper.—Cash, £345 10s. 0d. to £346 0s. 0d.; three months, £339 10s. 0d. to £340 0s. 0d.; settlement, £346 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 3s. 4⅝d. per lb.; rods, 384s. 3d. per cwt. basis; 20 s.w.g., 417s. 6d. per cwt.

Tin.—Cash, £752 0s. 0d. to £753 0s. 0d.; three months £749 10s. 0d. to £750 0s. 0d.; settlement, £753 0s. 0d.

Lead (Refined Pig).—First half May, £112 0s. 0d. to £112 5s. 0d. ; first half August, £111 5s. 0d. to £111 10s. 0d.

Zinc.—First half May, £97 0s. 0d. to £97 5s. 0d.; first half August, £95 15s. 0d. to £96 0s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £128 15s. 0d. ; rolled zinc (boiler plates), all English destinations, £126 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £114 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 8½d. per lb.; rods, drawn, 3s. 6½d. ; sheets to 10 w.g., 343s. 9d. per cwt.; wire, 3s. 3⅝d.; rolled metal, 328s. 9d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £217; B6 (85/15), —; BS249. —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £269; HTB2 (38 tons), — ; HTB3 (48 tons), £300

Gunmetal.—BS1400, LG2 (85/5/5/5), £308; LG3 (86/7/5/2), £320. G1 (88/10/2/½). —; (88/10/2/1), £400.

Phosphor Bronze.—BS1400, PB1 (AID released), £401 per ton.

Phosphor Bronze Strip, etc.—Strip, 495s. 9d. per cwt.; sheets to 10 w.g., 500s. 3d. per cwt.; wire, 4s. 10⅞d. per lb.; rods, 4s. 2½d.; tubes, 4s. 0¾d.; chill cast bars: solids 4s. 2½d., cored 4s. 3½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 3¾d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 8½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 7½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 4d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £85 0s. 0d. Nickel, £519 0s. 0d. Aluminium ingots, £189 0s. 0d.; aluminium bronze (BS1400), AB1, £365; AB2, —. Solder, brazing, BS1845: type 8 (50/50), 3s. 1d. lb., type 9 (54/46), 3s. 4½d.

* Average 68-70 per cent.